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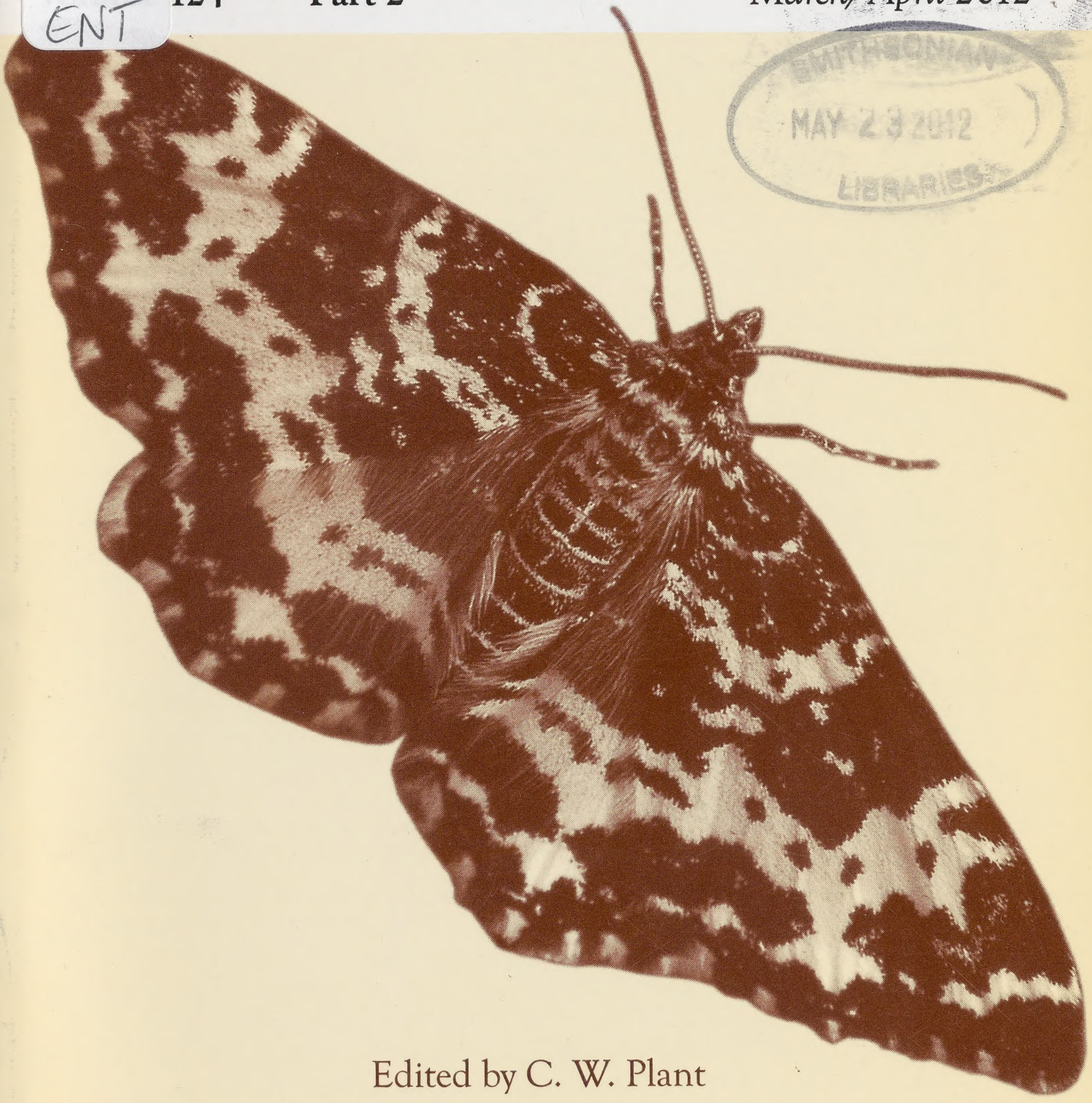

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Front cover image of *Rheumaptera hastata hastata* (L.) from photograph © by John Knowler

BROWNFIELD SITES AND INVERTEBRATE BIODIVERSITY IN THE POST-INDUSTRIAL ENVIRONMENT OF LONDON

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Abstract

The post-industrial environments of many European cities provide novel brownfield spaces which plants, invertebrates and even mammals are finding habitable. This paper discusses some of the knowledge accrued over the past half-century on brownfield habitat and their potential for urban biodiversity.

Introduction

Unparalleled changes in global urbanisation have occurred over the past century, though the picture is more nuanced than popularly hyped (Satterthwaite, 2007). Even as many urban areas are expanding, several are shrinking. This is happening particularly in post-industrial Europe, where an estimated 40% of its cities are in a process of permanent, medium-term or recent decline (Turok & Mykhnenko, 2007). As a result, there has been discussion about planning for shrinking cities, especially on how to deal with vacant and derelict ("brownfield") land. One aspect of this discussion touches on incorporating these spaces into the green infrastructure of the urban landscape, through tapping on their potential for urban biodiversity (Mathey & Rink, 2010).

Parallel to this debate, nature conservationists have also been working in London to promote conservation of its wildlife habitats, one of which is brownfield. Though London's population is not shrinking, but undergoing "long-term resurgence" (Turok & Mykhnenko, 2007), the issue of urban biodiversity and brownfield land is still relevant, as is officially acknowledged by the inclusion of "wasteland" habitats in the London Biodiversity Action Plan (London Biodiversity Partnership, 2007, *http://www.lbp.org.uk/londonhabspp.html*). Nonetheless, Harrison & Davies (2002) note that scientific knowledge about London's brownfield ecology has yet to be formalised amongst conservation practitioners. This is a problem that hampers the firm placement of brownfield wildlife conservation on the city's agenda, given the predominance of scientific rationality in the practice of UK nature conservation, and the high development pressures in the capital.

Here, I aim to provide a defence for the conservation of urban biodiversity and then to assess the status of biodiversity conservation in London with regard to what have popularly been labelled as "wasteland" habitats. I also provide a review of past and recent research about brownfield ecology in London and other European cities, in a manner which might be helpful for nature conservation practitioners. In this manner, I hope that this paper will contribute in some small way towards formalising the body of knowledge avaiable to nature conservation

proponents in London (and elsewhere), and enable them to promote the conservation of urban wildlife more effectively.

In defence of biodiversity

Biodiversity is simply defined by the Convention on Biological Diversity (CBD) as "the variety of life on Earth and the natural patterns it forms", encompassing differences between and within species, and the variety of ecosystems on the planet (*http://www.cbd.int/convention/guide/* accessed 9 January 2012). Using terminology borrowed from ethics (Beckerman, 2011), I argue that the conservation of biodiversity is both intrinsically and instrumentally valuable.

McCauley (2006) argues for the intrinsic value of nature in two ways. First, he points out that attempts to conserve biodiversity by appealing to 'ecosystem services' have failed repeatedly, and also mistakenly idealise nature as being benevolent when "environments don't act for the benefit of any single species" (p.27). Second, he asserts nature's "aesthetic beauty, cultural importance and evolutionary significance" (p.28). One can point to examples of people valuing biodiversity, aesthetically and culturally, in wildlife conservation campaigns which deploy 'flagship species' to promote conservation. These species have 'nonhuman charisma' that appeal to humans; Lorimer (2007) suggests that this charisma can stem from their visual attractiveness, the similarity of their organisation and seasonal rhythms to those of humans, or the extensiveness of the species' interaction with people over time. In addition, nature conservationists have been asserting the evolutionary significance of wildlife for a long time, without regard for the charisma of species. For example, Mark Spencer, Plant Recorder for the London Natural History Society, wrote to me (2012, pers.comm.), about his dislike of the term 'ecosystem services': "It is very unfortunate that plant conservation nearly always seems to be couched in terms of the services that plants provide for other organisms and humans in particular; such language when talking about charismatic megafauna would appear anachronistic. Without plant diversity we would all be dead!"

Unfortunately for Spencer and others, planners and policy-makers are still very much concerned with the instrumental value of biodiversity. This view of 'nature as resource' is predominant even in the CBD text (McAfee, 1999). It is hence necessary to discuss the instrumental value of biodiversity to engage policy-makers and planners. Uses of biodiversity appear to be in the general service of advancing human health and well-being, for example through discovery of new drugs and genetic material, or for more climate-related occurrences, such as carbon storage, temperature regulation, and flood mitigation (Kowarik, 2011). The literature on ecosystem services in the global context is well documented elsewhere, and I shall not dwell on it here.

Why urban biodiversity?

Cities cover less than 3% of the Earth's terrestrial surface (Nelson, *http://www.maweb.org/documents/document.272.aspx.pdf* accessed 7 January

2012), but also consume 75% of resources and produce 80% of the world's greenhouse gases (CBD, 2007 in Muller & Werner, 2010, p.4), creating an environmental impact disproportionate to their size. Indeed, urbanisation has effected huge changes in natural ecosystems, for example by contributing to habitat destruction and fragmentation, so that urban ecosystems are now regarded as novel (Kowarik, *op. cit.*).

Acknowledging this, Müller & Werner (2010) contend that urban biodiversity should be protected for a few reasons. First, precisely for its distinctiveness, since it has specifically evolved due to human impact; second, for its contribution to urban dwellers' health and well-being (for which they cite evidence from psychology and health studies); and third, for the compelling reason that "it might be the only biodiversity that many people experience" (p.22). This last reason comes from the fact that, as mentioned earlier, the increasing urbanisation of the planet's population is predicted to continue (Satterthwaite, 2007). Since awareness of environmental issues is influenced critically by people's experiences of nature in everyday surroundings (Savard *et al*, 2000), the conservation of biodiversity in cities is necessary for environmental education and ensuring biodiversity conservation into the future.

Urban biodiversity conservation needs to take its rightful place in the centre of urban policy. I shall now explore the situation of biodiversity conservation in London for brownfield sites.

"Wasteland" sites in London

In this essay, I use the terms 'brownfield' and 'wasteland' interchangeably, although the term wasteland perhaps does not facilitate recognition of the fact that such sites may have a value. Wastelands/brownfields are parcels of land that had been previously developed and contain surface infrastructure, but were subsequently left to fallow (Wittig, 2010). Wastelands occur for various reasons, ranging from the destructiveness of war or industrial accidents, to abandonment by industry or communities.

London wastelands and biodiversity conservation

In London, as mentioned earlier, wastelands have been officially acknowledged as valuable wildlife habitats. It would hence seem that there is a concerted wasteland wildlife conservation effort. However, reality seems to be rather more schizophrenic.

On the one hand, species-rich derelict land was included, albeit as a mention under "urban habitats", in the earliest drafts of the UK Biodiversity Action Plan, itself the first national BAP published in response to the CBD (*http://jncc.defra.gov.uk/ PDF/UKBAP_BiodivUKSGRep-Vol2-Tranche1-Annfg.pdf* accessed 7 January 2012). There have been funds administered under various governments for the conservation of brownfield sites in London, such as what the Single Regeneration Budget did for Deptford Creek in 1996 (Bertrand,

2011. pers. comm.). Some brownfield sites have also been afforded statutory protection, such as the Gillespie Park in Islington, designated a Local Nature Reserve in 1983 (*http://www.islington.gov.uk/DownloadableDocuments/Environment/Pdf/reserve_map.pdf* accessed 9 January 2012). In fact, brownfields are explicitly mentioned in policy guidance for designation of Sites of Importance for Nature Conservation in Greater London (London Wildlife Site Board, *http://www.london.gov.uk/ sites-importance-nature-conservation* accessed 9 January 2012). And of course, wastelands have their own Habitat Action Plan under the current London BAP.

On the other hand, UK planning discourse views brownfield sites as eyesores and marginal spaces, strongly encouraging new development on brownfield sites as a general rule. This attitude goes back to when brownfields first became the target of state policy. During the 1950s and 1960s, a number of parliamentary acts were legislated on the acquisition and redevelopment of derelict land for the improvement of amenities (Evans, 2002). The Derelict Land Act (1982), passed under Thatcher, referred to "derelict, neglected or unsightly" plots of land. Planning discourse also associates brownfield sites with urban crime, contamination and lowering property prices. For example, the Urban White Paper called brownfield sites "wasted assets", and warned that "…where they exist they can detract from the quality of the rest of the urban environment, they dent confidence in the future of the area and in some cases they can be a hazard to health" (DETR, 2000, p.68).

With these reasons, it urged that at least 60% of new development take place on such sites in future, in order to "reduce pressure for greenfield development" (DETR, *op.cit.*, p.70). This 'brownfields-first' attitude is echoed in academic literature on brownfield regeneration (e.g. Alker *et al*, 2000; Moffat & Hutchings, 2007). In this planning paradigm, which sits nicely with the British romanticisation of rural nature (Williams, 1975), the implied antagonism of 'brown' versus 'green' spaces shows that brownfields do not, at first instance, fit into any concept of urban nature (Bertrand, 2011, pers.comm.).

What has come out of these divergent attitudes to brownfield sites? Whilst some have indeed been protected, the vast majority of such sites in London have been turned over to developers who care little about biodiversity conservation (Harrison & Davies, 2002; Chipchase & Frith, 2002; Bertrand 2011, pers.comm.). Some examples are Gargoyle Wharf by Wandsworth Bridge and Barking Riverside in the Thames Gateway. Also, little progress has been made on the Wasteland Habitat Action Plan (BARS, 2012). Three out of four targets for the HAP are either behind schedule or have no report, and all of the "Actions" that are on schedule or completed are purely administrative, such as disseminating information or developing proposals. The Actions to do with actual conservation of wasteland habitats are all not started and behind schedule.

In contrast, for other HAPs, most Actions have either been completed or are on track, and many deal with the management and creation of protected sites in

London. Whether the stalling on the Wasteland HAP is due to the tardiness of the London Wildlife Trust (which is in charge of the HAP) or because of planning hurdles remains an open question. However, since the Trust is also active in the Private Gardens HAP, and most of its scheduled Actions there have been completed, it does seem as though planning hurdles might be playing a large role in preventing significant progress on wasteland habitat conservation in London.

London's rather erratic record on brownfield wildlife conservation could be due to a number of reasons. Harrison & Davies (2002) identified a problem to be the lack of an overarching body of knowledge and practice from which conservationists can draw and act in unison to promote biodiversity conservation in London's brownfields. There is an absence of large-scale studies on actual brownfield sites in London like those done for Berlin and Paris, and this results in knowledge gaps for practitioners.

Knowledge on brownfield ecology

Knowledge that plants can grow on man-made structures, such as rubble, has existed for a long time, but academic publications on brownfield ecology rose sharply only after the 1950s (Sukopp, 2002). I present here a brief review of European research on brownfield ecology at site, habitat/rarity, and city level.

Site

From a site perspective, the wildlife that occurs obviously depends on the makeup of the substrate and the topography of the site, and these in turn depend on the infrastructure left there and its evolution through time. Nevertheless, some generalisations can be made about wasteland habitat conditions. Wasteland soils enriched with brick and construction rubble are much more alkaline, have higher nitrogen, phosphate and potassium content, and might contain more minor elements from the emissions of industry and traffic (Sukopp *et al.,* 1979).This in turn determines in large part the types of plants and invertebrates which colonise the site. Nitrogen-fixing plants blown in by wind tend to be first, and these can grow with little water and produce seed quickly (Werner & Zahner, 2010). Examples are plants from the pea and mustard families. Sites with brick rubble also tend to contain greater plant cover, and have more species recorded than sandy sites without brick rubble (Schadek *et al.*, 2009). For invertebrates, the presence of dead wood in which to nest, as well as dry and sandy conditions, tend to favour ants, bees and wasps rather than flies (Gibson, 1998). In addition, the substrate is important. Many East Thames Corridor brownfield sites in Essex feature a pulverised fuel ash (PFA) substrate left over from former industry, and are presently important habitats for several nationally rare and scarce invertebrate species (Harvey, 2000; Thurrock Council, 2007). Sites that contain vertical structures can provide nests and singing posts for birds that normally roost on cliff faces and scree slopes, such as the black redstart (Black Redstart Action Plan, *http://www.blackredstarts.org.uk/pages/ecoredstart.html*, accessed 6 January 2012).

Habitat and rarity

It is generally agreed that wasteland habitats have high levels of biodiversity compared to other urban and rural habitats. Muratet *et al.* (2007), who studied 98 brownfield sites in the Hauts-de-Seine area of Paris, France, found that the number of plant species recorded in their brownfield sites represented 58% of the total floristic richness known for the entire area. Plants that grow in these disturbed spaces also tend to hybridise with each other more often, creating new gene-types (Sukopp *et al.*, 1979). Mabey (2010) gives the example of the crossing of the Oxford ragwort with the groundsel to create the London ragwort. Such hybridisation, whilst adding to biodiversity, also might represent a favourable adaptive response to a warmer climate (Walther *et al.*, 2009).

In addition, wastelands support significant numbers of nationally rare species of invertebrates. Gibson (1998) writes that 12-15% of Britain's scarce and rare invertebrates can be found in artificial habitats, and with this figure likely to be an underestimate. Harvey (2000) points out that many rare bees and wasps usually associated with dune habitats can be found in open sandy waste ground habitats across the UK. These include the Red Data Book solitary wasp *Cerceris quinquefasciata*, which is currently widespread in Britain only in the East Thames region, but most sites are threatened by development. Eyre *et al.* (2003) recorded multiple occurrences of 46 nationally rare and scarce species of beetles from 78 brownfield sites across England, with an old railway sidings in North London yielding the rarest species recorded (*Polistichus connexus*). They also noticed that several species more usually associated with sand or chalk grassland were found on old sand working and chalk waste, but on sand workings there were also a number of species usually found in river sediment. Even spiders have been found in significant numbers on brownfield sites – a noteworthy finding, as spider species abundance may be a good proxy of overall biodiversity potential of a habitat, since spiders occupy the mid-trophic level of the food chain (Kadas, 2006).

Studies have shown that the structural diversity of vegetation found in a habitat is the most important factor for birds' survival (Werner & Zahner, 2010). Hence, fewer mammals make urban wastelands their home, compared to woodland or rivers. Nevertheless, the London BAP Priority Species list flags six species of birds which can be found in London's wasteland habitats: the Black Redstart, Grasshopper Warbler, House Sparrow, Lesser Redpoll, Linnet, and the Marsh Warbler. All are tagged as either "red" or "amber" in the Red Data Book, and are 'culturally valued'. This contrasts with the three bird species in the list which are found in 'parks and squares'. Though birds are commonly found in parks and squares, they tend to be commoner species such as the feral pigeon and the blackbird (Sibley *et al.*, 2005). This suggests that for conservation purposes, wasteland habitat might be accorded a higher priority than parks and squares due to the bigger number of rare birds supported.

City

Seen on the city-scale, and also across time, brownfield habitats with different ages will be in differing stages of succession. Mathey & Rink (2010) classified the stages as such:

- Young wasteland with pioneer vegetation
- Older wasteland with persistent ruderal vegetation
- Old wasteland with ruderal tall herbaceous vegetation
- Wasteland with spontaneous woodlands

Research has found that there is likely to be a "humped-back" model of plant species richness in brownfield sites. This suggests that biodiversity of a newly-colonised brownfield site increases over time, peaking when a community comprises a mixture of early and mid-successional species of vegetation, and declines thereafter as tall, woody species block out light from the ground and dominate the uptake of nutrients. This peak of biodiversity is estimated to be reached after approximately five (±2) years from the time of first colonisation (Muratet *et al.,* 2007; Schadek *et al.,* 2009). As a result of this finding, it has been suggested that there is an 'optimal' brownfield disturbance rate which maintains peak plant species diversity in brownfield sites whilst permitting development.

This is an interesting way of resolving the development versus biodiversity debate. However, for London, there is yet no research into rates of net brownfield creation and biodiversity, though a cursory look into the National Land Use Database of Previously Developed Land, and personal communication with nature conservationists, indicate that brownfields are disappearing more quickly than they are created in London, suggesting a net loss of biodiversity. More research is needed, though the idea of an optimal disturbance rate does offer an intriguing solution to reconciling conservation with development pressures.

A caution

There is an important point that needs to be raised. Many common plants growing in urban areas are non-native, compared to the suburbs or the countryside (Angold *et al.*, 2006; Kowarik, *op. cit.*), which is true also for London (Spencer, 2012, pers.comm.). These species tend to be invasive 'generalists', and are found in cities across the world, in a phenomenon dubbed 'biotic homogenisation' (McKinney, 2006). This raises questions about whether native species should be prioritised for conservation. Some agree that conservation should target native taxa as first priority, since this helps in maintaining "regional biotic uniqueness" (McKInney, *op. cit.*; Spencer, 2012, pers. comm.). On the other hand, others point out that the boundaries between 'native', 'archaeophyte' and 'neophyte' are necessarily ambiguous, and in a world where global warming is modifying the habitable ranges of species, boundaries between 'invasion' and 'migration' are becoming blurred (Walther *et al.*, 2009). Non-native flora that have hitherto adapted to warmer urban heat islands might become naturalised in more rural locations as average

temperatures rise (Nowak, 2010) and the potential value of such plants in the support of invertebrate biodiversity has been emphasised by Bodsworth, Shepherd & Plant (2005). In fact, as early as 1979, Sukopp *et al.* wrote that places where wasteland flora grow "...are the field laboratories where possibly new and well-adapted ecotypes of our native or naturalised wild plants will originate in the changed environmental conditions. Ecosystems which have developed in urban conditions may be the prevailing ecosystems of the future." (p.130). There is hence a fine line to walk when discussing native, non-native, and invasive species.

Conclusions

There are multiple forces at work that push us to look at biodiversity conservation in urban brownfield sites across the world. Shrinking cities in various places will have to deal with land vacated by emigrant people and businesses, whilst in others the dynamics of capitalism still necessitate the creation of derelict land and their eventual development. At the same time, biodiversity losses have to prompt us to act decisively, before vulnerable species are lost. This paper has attempted to contribute to the literature on knowledge with regards to brownfield nature conservation for London and in cities more generally, first by defending urban biodiversity conservation, then by providing an up-to-date assessment of the status of wasteland conservation in London, followed by a summary review of knowledge on brownfield ecology so far. It is hoped that in an era of increasing human impact on Earth, the full spectrum of biological life and habitats will not be lost, but preserved into the future.

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Dicyphus escalerae Lindberg (Hem., Miridae) in Oxford

On 10 July 2010 I was walking along Walton Street, Jericho, Oxford on my way to the annual St Barnabas School Fete, when I noticed some snapdragon *Antirrhinum majus* (Scrophulariaceae) growing from the base of a wall (O. S. grid reference SP 508069). There were about a dozen flower heads and, remembering recent comment about the above species on this plant (Kirby, Bantock & Nau, *Het News*, number 13, 7-8, Spring 2009), I had a look. I spotted a single thin, dark bug, but with my close-vision not being what it used to be, I could not be certain of the insect's identity. I had nothing with me to capture the bug, but reasoning that, unlike me, the insect was probably not going anywhere, I let it be and carried on to my appointment at St Barnabas School.

On my return from the fete two hours later, clutching a small plastic bag that I had retrieved from a rubbish bin, I secured the bug with its flower head. At home, under the microscope, I found the insect to be a perfect match for that depicted in Tristan Bantock's photograph (*loc. cit.*). I made another search in the area on 22 July 2010, and took several more specimens on snapdragon in a yard behind the school, and along the walls of some boarded-up council flats on the other side of the road.

The first published records of this species in Britain were those of Peter Kirby on 13 May 2008 at Battersea, London, and Tristan Bantock in Leicester on 15 November 2008 (*op. cit.*). Subsequently, Berend Aukema found the bug in Teignmouth, Devon on 22 October 2009 (*Het News*, Spring 2010, 15: 10) and John Widgery discovered it in his garden at Woodmancote, Gloucestershire, on 17 August 2010 (*Het News*, Autumn 2010, 16: 12), both records on snapdragon. Paul Whithead (2010. *Entomologist's Monthly Magazine* 146: 17-19) published records for Llandudno, Wales (1 October 2006), Evesham, Worcestershire (12 October 2008) and Winchcombe, Gloucestershire (28 October 2009).

The insect is, clearly, now widespread across southern Britain, and many more records are likely as entomologists examine the streets, parks and gardens of our urban areas.

Some excellent images of this bug can be found by searching *www.flickr.com*, whilst the photograph mentioned above can be found at *www.hetnews.org.uk.* — Rob Ryan, 38 St John Street, Oxford, OX1 2LH (E-mail: notnowcato@ymail.com).

BUCCULATRIX CHRYSANTHEMELLA REBEL, 1896 (LEP.: BUCCULATRICIDAE) NEW TO BRITAIN

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Abstract

Bucculatrix chrysanthemella Rebel, 1896, is added to the British list of Lepidoptera. The moth, its genitalia and larval workings are illustrated.

Keywords: *Bucculatrix chrysanthemella*, Leaf mine, *Argyranthemum frutescens*, *Gonospernum fruticosum.*

Introduction

As a matter of routine, I identify the micro moths from the light trap operated by James Fish and Julian Reeves in their adjoining gardens at Bishops Stortford, Hertfordshire. Whilst looking at material collected during 2009, I came across an unfamiliar micro which, since it lacked a head, legs and half of its scales, had to be resolved primarily through genitalia dissection. I tentatively named this as *Bucculatrix artemisiella* H.-S. using Svensson (1971). I had excluded the most likely candidates: *B. maritima* Stainton & *B. absinthii* Gartner, by their genitalia and *B. gnaphaliella* Treitschke by the moth itself. However, Colin Plant pointed out to me that that *B. artemisiella* had not been reported in Britain since 1865 (Emmet, 1985). Having since queried the 1865 record, it appears that *B. artemisiella* has in fact never been *reliably* recorded in Britain (John Langmaid, pers. comm.); clearly this specimen required a second opinion as it had become evident that this might be a new species for the British fauna. Colin e-mailed the image to Ole Karsholt for an opinion and was at once referred by him to Zdeno Tokar, a specialist in this family; Dr Tokar recognized the genitalia immediately as belonging to *Bucculatrix chrysanthemella* – a species not previously recorded in the British Isles.

Bucculatrix chrysanthemella Rebel, 1896

Description of Imago (Plate 4)

Based on a translation of Rebel's original description and examination of 15 specimens in the Walsingham Collection at the Natural History Museum (BMNH) the following description is offered:

Male: The moth is close in appearance to *B. maritima*, although smaller with broader white basal wing-stripes. The **head** is covered with rough, erect scales whitish at the edges, with the middle darkened brownish, the eye-caps which are mostly hidden by the head-scales are also whitish. The **antennae** are brown-grey dorsally, fading paler to the tip, whitish ventrally. The **thorax** is frontally edged whitish, with darker central scales the same general colour of the upperparts, white-

grey beneath. The **legs** are dusty grey dorsally, whitish cream underneath with tarsi darkly spotted on the exterior; the hind-leg spurs are darkly spotted like the tarsi. The **abdomen** is light grey with the anal tip lighter. **Forewing** with ground-colour ranging from rich chestnut brown to pale chestnut brown, markings pure white. White basal bar to over half-way, occasionally as far as ¾, edged darker towards fold. Triangular white costal patch at ¾ with another at the wing tip, white dorsal patch at ¾ occasionally reaching basal bar, but usually separated by at least a few dark scales. An additional white patch below basal bar at $^{2}/_{5}$, occasionally obsolete or reduced to a few scales, usually edged by a patch of darker scales towards wing apex. Darker patch of scales at junction of basal bar, dorsal, costal and wing-tip patches. Cilia pale greyish, darkening towards the tip, with two lines of darkened scales. Hindwing whitish/pale silvery grey; hind-wing cilia same.

Female: Similar except that abdomen anal tip is darkened brownish and the hind-wing cilia are creamier.

Male Genitalia (Figs 2 and 4)
Similar to *B. absinthii*, but lacks the sclerite on the socius: Distinguished from *B. maritima* by the shape of the valva.

Female Genitalia (Figs 3 and 5)
The long, relatively straight antrum of this species distinguishes it from the *B. absinthii* group, which have a distinct bend to the right. The antrum in *B. maritima* is considerably shorter and in *B. gnaphiella* shaped differently.

Larval Food Plants
In its native Canary Islands, *B. chrysanthemella* is known to feed on Marguerite Daisy *Argyranthemum frutescens* and Canary Tansy *Gonospernum fruticosum*. Of these two, the former regularly imported as a garden plant; indeed this species is cited as the food-plant in each of the cases where the species has turned up elsewhere. Good images of both these plant species can be found at *www.ukwildflowers.com*.

Larval Development
According to European literature (e.g., Coquempot & Nel, 2009), the eggs are laid separately on the surface of the leaves. The newly emerged caterpillar immediately penetrates the leaf and continues its growth within a linear gallery which progressively enlarges until nearly the whole leaf-lobe is occupied (Fig. 1). As yet, the larval leaf-mines remain unrecorded in the UK; hopefully this article will stimulate the search and photographs of the leaf mines will appear in the literature soon.

In optimal conditions the complete life-cycle takes 40 to 45 days, with the larval development varying between 17 to 25 days and the pupal stage from 10 to 15 days (Constanzi *et al,* 2008).

1

2

Plate 4. *Bucculatrix chrysanthemella* (Rebel, 1896). 1 & 2. Adult live moths, photographs courtesy of pathpiva.com; 3. specimen 78929, Walsingham collection, in NHM London, photographed with kind permission of the Trustees of the Natural History Museum.

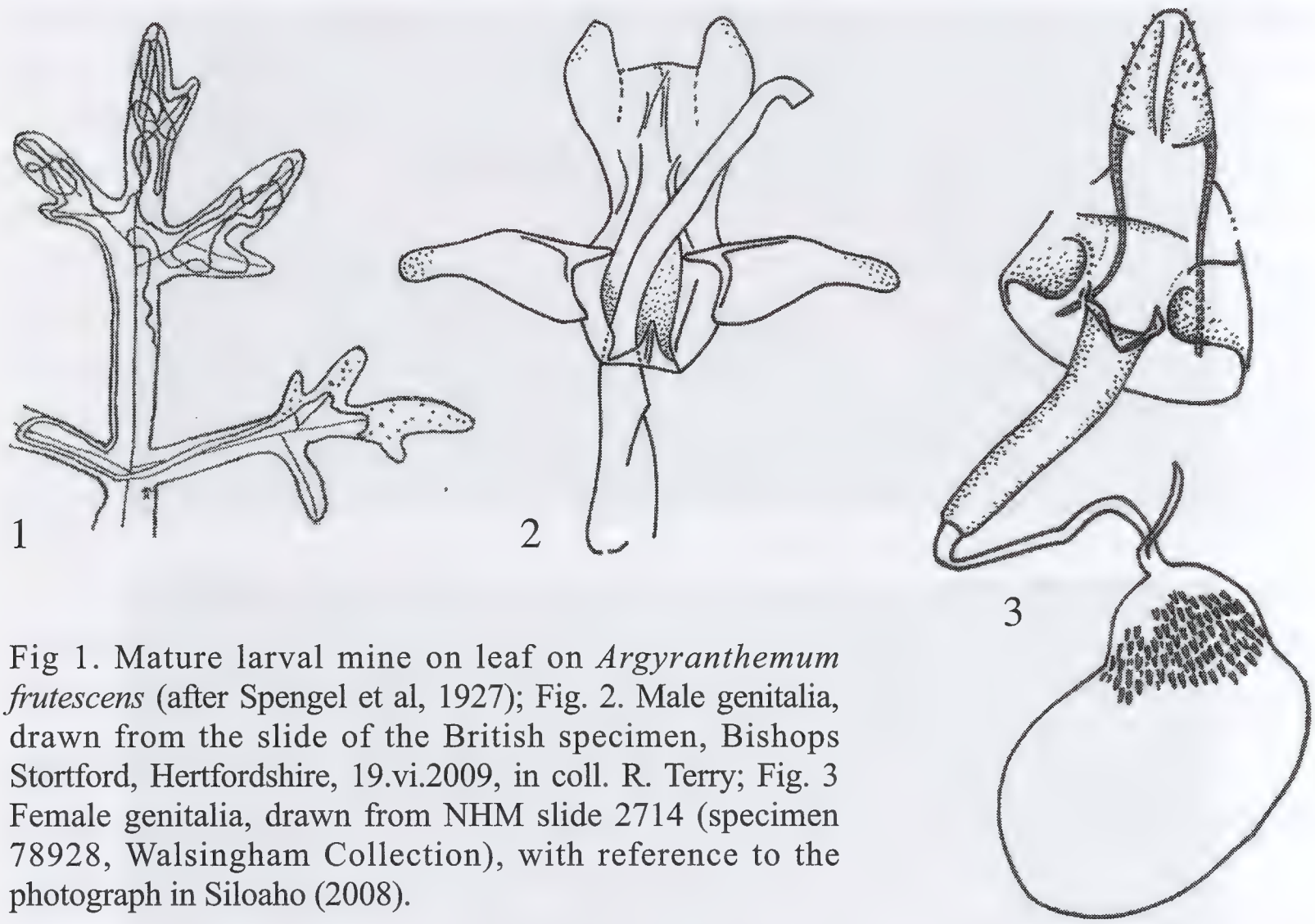

Fig 1. Mature larval mine on leaf on *Argyranthemum frutescens* (after Spengel et al, 1927); Fig. 2. Male genitalia, drawn from the slide of the British specimen, Bishops Stortford, Hertfordshire, 19.vi.2009, in coll. R. Terry; Fig. 3 Female genitalia, drawn from NHM slide 2714 (specimen 78928, Walsingham Collection), with reference to the photograph in Siloaho (2008).

Distribution

The details of the British record are:

Bishops Stortford, Hertfordshire (VC 20; O. S. grid reference TL 4822); 1♂ at mv light, 19.vi.2009, leg. J. Fish & J. Reeves, det. & in coll. R. Terry, 2012.

This species is not listed in the recent European checklist (Karsholt & Razowski, 1996), but it has evidently been extending its range in recent years. Although the Fauna Europaea web site (*http://www.faunaeur.org/distribution_table.php*, accessed 3 March 2012) lists its presence only in the Canary Islands, the species has now been positively recorded well away from here in Finland during 2006/7 (Siloaho, 2008), Italy during 2007 (Costanzi et al, 2008) and France during 2008 (Coquempot & Nel, 2009).

Conclusions

It is clear that this species is being transported via the garden trade. It is possible that with the publication of this paper others will be prompted to look for this species and *B. chrysanthemella* will be found elsewhere in the UK. Potted 'Marguerite Daisies' are regularly sold in supermarkets as well as garden centres, so there is a good chance of further introductions. In the current British checklist (Bradley, 2000) *B. chrysanthemella* should be allocated the number 269a.

Acknowledgements

I am grateful to: Jim Fish and Julian Reeves for providing specimens of micros annually for determination; Brenda Marney and Tom Warner for their translation

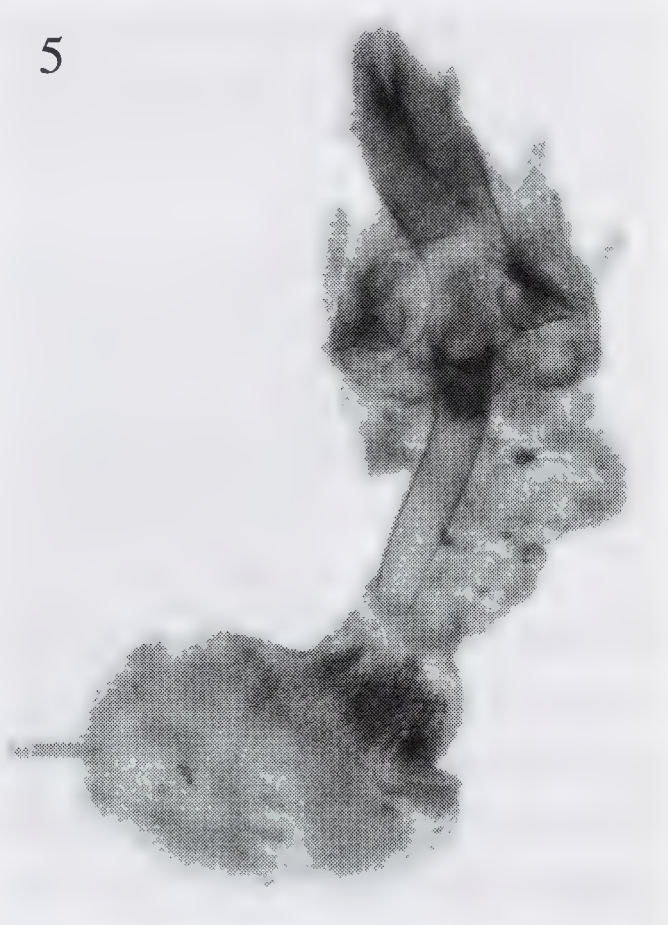

Fig. 4. Male genitalia. NHM slide 2762 (specimen 78923, Walsingham Collection); Fig. 5. Female genitalia, photograph of NHM slide 2714 (specimen 78928, Walsingham Collection).

of French & German texts; Martin Honey at the Natural History Museum, for assistance and access to the Wallsingham Collection and relevant papers; Dr Zdeno Tokar for providing the identification of the specimen; Ole Karsholt, Willem Ellis, Colin Plant and John Langmaid for additional helpful comments and information. I am also grateful to *www.pathpiva.wifeo.com* for permission to use their images of live moths.

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PSEUDOCOCCYX TESSULATANA (STAUDINGER, 1871) (LEP.: TORTRICIDAE, OLETHREUTINAE) IN BRITAIN

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Abstract

Pseudococcyx tessulatana (Staudinger) is recorded for the first time in Britain.

Introduction

In mid December 2011, Mr Ian Marshall passed to the author a few tubes of unmounted micro-moths for determination or confirmation of identity. Most were of specimens taken by himself, but the material included a single tortricoid moth that had been captured in her small garden in Bridlington, east Yorkshire (VC61) on 30 August 2011 by Mrs Lenora Bruce, whose interest in moths was relatively recent. Ian had provisionally labelled the moth as [*Lozotaeniodes*] *formosanus* but evidently had concerns about its identity. As soon as I saw the Bridlington moth I recognised it as *Pseudococcyx tessulatana*, as I had previously determined examples of this very distinctive species brought back from the Balearic Islands by a friend. My initial reaction was that there was no previous British record of this moth – a supposition that was subsequently confirmed by Dr John Langmaid.

Diagnosis

A full description is not provided as the Bridlington specimen was not in the best of condition when received, lacking antennae and some legs (Plate 5). However *P. tessulatana* is an extremely distinctive moth, unlikely to be confused with any other European species. With a wing expanse of 13-17 mm (Razowski, 2003), it is smaller than its congeners and smaller than *Rhyacionia buoliana* [(D. & S.]) and *R. pinicolana* (Doubleday), the only British moths with which it bears any resemblance at all. The forewing has a characteristic salmon pink ground colour with narrow black transverse lines, with the post median and sub-apical lines connected by a line of black scales.

The adult moth is illustrated by Parenti (2000) on plate 120 fig. 2 (as *Blastesthia tessulatana*) and by Razowski (*op. cit.*) on plate 12, fig. 355 (also as *Blastesthia tessulatana*) although that illustration has a much darker (brown) ground colour than any specimens that I have seen. The male and female genitalia are illustrated by Razowski (*op. cit.*) on plates 34, fig. 355 and plate 80, fig 355 respectively, both over the name *Pseudococcyx tessulatana*.

Biology and Distribution

According to Razowski (2003) [quoting Swatschek (1858)] the larvae feed in the fruits of *Cupressus* species from September to April. *C. sempervirens* (Green

Cypress) would appear to be a frequent foodplant,but *Juniperus* species have also been mentioned. Surprisingly, Razowski does not give the time of appearance of the adult moths, but a number of other sources suggest that they fly from late April to August in southern Europe.

Plate 5. *Pseudococcyx tessulatana* (Stdgr.), Bridlington, Yorkshire, 30.viii.2011. Leg. L. Bruce. In coll. H. Beaumont.

Pseudococcyx tessulatana is widely distributed in southern Europe from Portugal and Spain eastwards to Greece and Bulgaria and north to Switzerland. There are sporadic records further north in Europe where it may be increasing its range. It is also present in eastern Europe and in north Africa.

Discussion

Although the moth was captured in a coastal locality it seems unlikely that it was an immigrant from continental Europe, as there was no evidence of other immigrant species at that period. As the larval foodplants are widely planted garden and amenity trees the likelihood is that its origin was introduction by horticultural trade. However, as the larvae feed in the fruits that would involve mature trees that are perhaps less likely to be transported. The moth taken at Bridlington was a female so there is a possibility that the species is, or might become, established if the larvae are able to survive the British winters. In view of its mainly southern distribution in Europe this is far from certain.

In the British Checklist (Bradley, 2000) this species should follow *Pseudococcyx turionella* (L.) and be allocated the number 1209a. In economic literature (e.g., Cantani & Battisti, 2001) it has the English name of Cone Tortricid.

Acknowledgements

Thanks are due to Mrs Lenora Bruce for retaining the specimen and to Mr. Ian Marshall who passed it over to me. Dr J. R. Langmaid kindly confirmed that, to his knowledge, there has been no previous British occurrence.

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Moths on West Lothian 'bings'

Parts of West Lothian's skyline is dominated by large heaps of spoil between 35 and 90 metres high. These 'bings' are the waste material from a process used to extract oil from deep-mined shales. Unlike coal spoil, shale-oil waste is non-toxic and alkaline. It is nutrient poor and most bings have large areas of bare rock pieces. In terms of moths they hold Northern Rustic *Standfussiana lucernea* (L.) which is usually a mountain or rocky coastline species not otherwise found within 50 miles. Other species largely restricted within the county to the bings, where they appear in good number, are Shears *Hada plebeja* (L.) Broad-barred White *Hecatera bicolorata* (Hufn.) and Lunar Underwing *Omphaloscelis lunosa* (Haw.).

West Lothian does also have some coal waste. Some of the spoil heaps have been landscaped. One of these, at the coast, holds good numbers of Heart & Club *Agrotis clavis* (Hufn.) which is a species that is not found elsewhere in the county. Another inland former opencast site has Shears, Broad-barred White and the only recent record of Brindled Ochre *Dasypolia templi* (Thunb.) in the Vice County. Despite being inland and there being plenty of coastal ragwort, it is also suspected to have the only breeding colony of Cinnabar moth *Tyria jacobaeae* (L.) in West Lothian. — MARK CUBITT, 12 Burgh Mills Lane, Linlithgow, West Lothian EH49 7TA.

Wastelands as steppes: the presence of *Cucullia fraudatrix* Eversmann 1837 (Lep.: Noctuidae) in Berlin

On the evening of 17 July 2009 I found a specimen of *Cucullia fraudatrix* Eversmann 1837 (Noctuidae, Cuculliinae) in an area of waste ground between the districts of Mitte and Wedding (Plate 6) located near to the centre of Berlin. This interesting five-hectare site where the former Berlin Wall once stood had developed since 1990 into a species-rich dry grassland in the early stages of ecological succession towards secondary woodland comprising Silver Birch *Betula pendula*, Grey Alder *Alnus incana* and other species. The adult moth was

flying around a patch of its larval foodplant, Mugwort *Artemesia vulgaris*, growing alongside other typical flora of wastelands in Berlin such as Tansy *Chysanthemum* (*Tanacetum*) *vulgare*, Yarrow *Achillea millefolium* and Viper's Bugloss *Echium vulgare* (see Sukopp, 1990. *Stadtökologie: Das Beispiel Berlin*. Dietrich Reimer, Berlin).

Cucullia fraudatrix has been recorded from central and eastern Europe with its range extending eastwards through Russia to Korea. It is a species associated with dry grasslands or steppes and is considered scarce through much of its range (Ronkay and Ronkay, 1994. *Noctuidae Europea. Cuculliinae I.* Entomological Press, Sorø). During the twentieth-century it appears to have extended its distribution in Europe: during the 1950s, for example, there were a series of new records in Austria, Germany and southern Scandinavia, including urban areas (Friedel, 1959. Cucullia fraudatrix Ev. im weiteren Vordringen nach Westen. *Zeitschrift der Weiner Entomologischen Gesellschaft* **44**: 91; Warnecke, 1956. Bemerkenswerte Beobachtungen von Nachtschmetterlingen in Berlin in den Jahren 1954 und 1955. *Mitteilungen der deutschen Entomoligischen Gesellschaft* **41**: 30 and Warnecke, 1958. Die neue Ausbreitung von Cucullia fraudatrix Ev. in Mitteleuropa. *Zeitschrift der Weiner Entomologischen Gesellschaft* **43**: 22-25). By the 1990s it had been recorded from over half the 16 German Länder, but remained absent from the south and west (Gaedike & Heinicke, 1999. (eds.) *Verzechnis der Schmetterlinge Deutschlands*. (Entomofauna Germanica 3). Entomologische Nachrichten und Berichte, Dresden). This mid-century expansion in its range may have been facilitated by a proliferation of ruderal sites that resembled some of the characteristics of its usual habitat. More recently *Cucullia fraudatrix* again appears to be extending its range westwards and northwards though it remains absent from Belgium, France, the Netherlands and much of Mediterranean Europe (Karsholt and Razowski, 1996. (eds.) *The Lepidoptera of Europe: a distributional checklist*. Apollo Books, Stenstrup).

Cucullia fraudatrix (Plate 7) has been placed in category V (threatened) on the German Red List of endangered species so its presence in an urban habitat is of ecological interest (Brandenburg Landesumweltamt, 2001. *Gesamtartenliste und Rote Liste der Schmetterlinge ("Macrolepidoptera") des Landes Brandenburg* Landesumweltamt, Brandenburg). Since my initial observation in 2009, however, much of this site has been lost due to the construction of a petrol station and the creation of temporary parking space. Within Berlin more generally, the ecological significance of urban wastelands or abandoned spaces for biodiversity is becoming more widely recognised, but this may prove too late for this particular site. It would be useful to consider which vulnerable species are closely associated with urban wastelands and develop a more precise typology of urban habitat types and their associated flora and fauna. — MATTHEW GANDY, Department of Geography, University College London, 26 Bedford Way, London WC1H 0AP (E-mail: m.gandy@ucl.ac.uk).

Plate 6. Brownfield habitat on the site of the former Berlin Wall, unfortunately now developed as a car park and petrol station.

Plate 7. *Cucullia fraudatrix* Eversmann, a Steppe species that may colonise urban brownfield sites.

Brownfield mothing long ago

Almost all my early mothing was done on brownfield sites, although at that time they were not known as such. It seems to be a relatively recent term, at least in its present meaning. Even as late as 1993, *The Chambers Dictionary* defined a brownfield site as "having undergone semi-rural or agricultural development" (Schwarz, C. (ed.), 1993. *The Chambers Dictionary*. Chambers Harrap Publishers, Edinburgh). Today, the official definition specifically excludes previous agricultural or forestry use. Only derelict urban and industrial sites, contaminated land, or redundant infrastructure such as disused railways, now qualify as brownfield.

Certainly there were plenty of these in the Salford (today part of Greater Manchester) of my boyhood years, during the 1950s and early 1960s. It was not long after the end of the war and the economy was struggling. Rationing was still a recent memory. Money and materials for rebuilding were scarce, so derelict land was everywhere. Within half a mile of my home were several former bomb sites, where the rubble of destroyed houses had been roughly bulldozed away. Ironically, we called them crofts – they had indeed been used to grow vegetables during the conflict. Now they made great places for us kids to play, despite the broken masonry, twisted rusty metal and shards of glass half hidden by the long grass and weeds. "Do be careful" was all the health and safety advice we received in those days. Nor was there much sympathy for the occasional bruised knee or cut finger. It was, of course, our own silly fault, and big boys don't cry.

By that time I was already interested in moths. On mild nights they sometimes came to the kitchen window, or I would find them at rest on walls and fences on my way to and from primary school, adding interest to the long trudge. Despite the unpromising surroundings, some species thrived. Indeed, Gothic *Naenia typical* (L.), Cabbage Moth *Mamestra brassicae* (L.) and Dot *Melanchra persicariae* (L.) were commoner there than anywhere I've lived since. Certainly there was no lack of weeds for their caterpillars. My second-hand copy of South's two volumes (South, R., 1907-08. *The Moths of the British Isles*, Series I & II. Warne), became increasingly grubby as I thumbed through the pages. Quickly I learnt a useful rule: anything I found was almost sure to be described as "generally distributed, and often common, throughout the British Isles". There was little hope of rarities here. So it was very exciting to catch a Wormwood *Cucullia absinthii* (L.). South did not even mention its occurrence in the north of England! Yet I was confident of the identification. We now know that this previously southern and coastal species rapidly took advantage of the derelict industrial wasteland resulting from the Second World War, colonising bomb sites in London, Birmingham and even Salford. Certainly there were huge stands of its foodplant mugwort *Artemisia vulgaris* on the 'croft' at the bottom of our road – I used the long straight stems as arrows for my home-made bow. Elephant Hawk-moth *Deilephila elpenor* (L.) similarly took advantage of the rosebay willow-herb

Chamerion angustifolium that had also invaded the area. I found my first caterpillar on the same bomb site. It was a huge and fearsome beast! So I persuaded my dad to capture it for me, and the following spring it produced the most wonderful moth I had ever seen.

Once I became old enough to venture further from home, vast expanses of derelict urban and industrial brownfield land awaited me. At nearby Agecroft there was a colliery that had covered much of the surrounding area with mountains of poor quality coal destined for the local power station, and infilled the hollows with heaps of shale – a good source of fossil ferns. The roads and tracks were made of cinder, presumably some waste product of coal gas extraction. There was a railway goods marshalling yard and a locomotive shed (Agecroft 26B, if I remember correctly), also on a cinder base. This was surrounded by a solid fence made of old railway sleepers – a good source of resting moths. Pugs were particularly numerous. I found these difficult, especially as many species were entirely melanic in the area at that time. At least this taught me how to use shape and jizz, since that is all there was. Grey Pug *Eupithecia subfuscata* (Haw.) was the most numerous, in its 'Paisley Pug' form *obscurissima* Prout. It took me years to nail this one down with the help of Allan Brindle at Manchester Museum. However, given the rampant umbellifers growing alongside the fence I suspected the melanic forms *angelicata* Barrett of Triple-spotted Pug *E. trisignaria* H.– S. and/or White-spotted Pug *E. tripunctaria* H.– S. were also present at a lower density. Some melanics looked subtly different, but I could not prove it. Back then I had never heard of genitalic determination (or genitalia for that matter).

The far end of the site was bordered by a mainline railway, the former LMS route to Glasgow. For part of its way near Agecroft Junction it ran parallel to the Bury, Bolton and Manchester Canal. By then, this was largely derelict with some sections drained and the rest a depository for rubbish. In those days before computers and television, most kids had hobbies, not all of them involving mischief. "Nothing to do" was never a complaint, at least in fine weather. On the contrary – the weekends and school holidays were simply not long enough to fit everything in. But here was an opportunity to combine several interests: fishing in the canal, train-spotting and mothing too! Thus I found the white silk cocoons of Gold Spot *Plusia festucae* (L.) in bent-over leaves of reed canary-grass *Phalaris arundinacea* while waiting for the fish to bite. I took home half a dozen. The freshly emerged moths were amazing, but a couple of large ichneumons gave me a nasty scare. One day I caught no fish but found a freshly emerged Crescent *Celaena leucostigma*, a new species for me at the time. Pulling up grass tufts along the canal towpath to look for bait often revealed more than worms. In a particularly sandy section I found many Flounced Rustic *Luperina testacea* (D.& S.) caterpillars and pupae amongst the roots of the fine grasses, though it was a slight anticlimax when the moths emerged. Naturally I'd been hoping for something scarcer. Nevertheless, it is a larva I've never come across since.

This section of the canal had even more to offer, as I found when old enough to be allowed to stay out after dark. On the site of a demolished factory or workshop beside the towpath was a large mound of slag or smelting waste of some kind or other; it had a rather igneous appearance. Whatever its origin it was clearly alkaline, because it supported thriving clumps of bladder campion *Silene vulgaris*, not present elsewhere. One warm calm June evening I went there at dusk, slightly nervous about the rats that were certainly present and the bogeymen who might have been. It was worth the risk. My first moth was a Tawny Shears *Hadena perplexa* (D.& S.) netted at the flowers. Several Marbled Coronets *H. confusa* (Hufn.) in mint condition quickly followed. These were exciting and unexpected moths compared with the mundane species I normally caught. Later I netted a Campion *H. rivularis* (Farb.) which was also new for me, with a lilac tinge not present in the Lychnis *H. bicruris* (Hufn.) we had in the garden. Even after 50 years, that was a memorable evening in an incongruous setting.

With the help of a second-hand bicycle, I extended my range further. Towards Clifton and Kearsley the canal had been drained. Weeds and scrub had taken hold on its former bed. Sallow *Salix* bushes flourished where the ground was still damp. On them I found my first Eyed Hawk-moth *Smerinthus ocellata* (L.) caterpillars, another unexpected highlight – this was a species I'd only read about in the books. Elsewhere in the drained section there were colonies of Narrow-bordered Five-spot Burnet *Zygaena lonicerae* (Scheven) and Chimney Sweeper *Odezia atrata* (L.), taking advantage of the varied vegetation that had rooted in the fertile mud. Bordered Pug *Eupithecia succenturiata* (L.) was another of the 'better' brownfield moths, associated with the clumps of mugwort in the drier places, often growing on dumped building rubble with the help of the lime mortar.

At Clifton there was a small offshoot of the main canal, named on the map as Fletcher's Canal. Who he was and why he built it I do not know. His canal was long disused and very silted up, choked by lush emergent vegetation and with sallow and alder *Alnus glutinosa* growing in its bed. This proved a surprisingly rich site for moths. One of its earthen banks was sparsely covered with fine grasses, which made it possible to spot resting moths of species that are not normally found by day. I amassed a good series of Powdered Quaker *Orthosia gracilis* (D.& S.) that included several pink and brown forms, and also added Double Lobed *Apamea ophiogramma* (Esper) to my list. About half of the latter were melanic, as were many of the Small Clouded Brindle *Apamea unanimis* (Hb.) I reared from pupae easily found behind loose alder bark. At the time I valued these gloomy melanics rather less than the more colourful typical specimens, but I have never seen such forms since.

At night, Fletcher's Canal was equally productive. To reach it I cycled at dusk along the main canal towpath without using a headlamp, so as not to waste the precious batteries that would soon be needed to catch and pot my moths. The massive stone blocks that formed the edge of the canal bank provided the

smoothest ride, but left little margin for error at speed in the gloaming. I still blanche at the memory of one particularly hazardous wobble when I hit a loose stone. It so nearly had me in the water – and I could not swim!

For various reasons, the microlepidoptera remained beyond my scope. I had no books to identify them, nor could I mount them on my mother's sturdy dressmaking pins to form a collection. I appreciated the beauty of the tiny metallic things that sometimes came my way, and could recognise a few distinctive tortricids like *Epiblema cynosbatella* (L.) from our garden roses, but otherwise they were (and still are!) too difficult for me. Even the curious tale of the 'Manchester Tinea' *Euclemensia woodiella* (Curtis) (see Sidebotham, J., 1884. The Story of *Oecophora woodiella*. *The Entomologist* 1884: 52-54; Melvill, J. C., 1924. A Sketch of Kersall Moor. *The Lancashire and Cheshire Naturalist* 1924: 207-212) failed to inspire me as much as it should have done. Yet the site where in 1829 the hapless Cribb discovered this species new to science, beside the River Irwell on Kersall Moor, was within my patch. With great ceremony I was shown one of the three surviving specimens in the Manchester Museum. Alas, I failed to appreciate the honour at the time. Like Cribb's alehouse landlady I was underwhelmed, having been expecting something altogether larger and more colourful. I now regret spurning the chance to search for this enigmatic species, though doubtless it was long extinct by then.

All this was over 50 years ago. The landscape was already changing when I left Salford for the Sussex Downs in 1964. New houses had been built on most of the nearby bomb sites where we used to play. New roads and trading estates were destroying familiar derelict wasteland, its weeds and scrub giving way to concrete and tarmac. I doubt if much remains of my old haunts now, or even if I'd recognise them at all. Certainly the air is cleaner. Lowry was from Salford and his paintings say it all. His skies are never blue, nor do they have clouds. They are always a uniform grey, ranging from lead to pewter and aluminium. That is the smoke haze. That is just how it was. The smoke came from innumerable domestic chimneys burning cheap low-grade sulphurous coal, fires being needed even in summer to heat the water. This was bad enough. Worse was the more acrid smoke from steam locomotives, power stations, mills and factories, smelters, chemical works – we had them all: ICI, Courtaulds, Pilkington Glass, Exide batteries. I can smell them yet. Who knows what noxious substances were discharged into the atmosphere from their tall stacks, to fall as acid rain or be breathed in as smog? There were few restrictions then. Who can say what toxic waste was discharged into the water courses or dumped as landfill? Brownfield sites today are clean and harmless places by comparison.

Yet some moths thrived in these extreme habitats despite the pollution and the soot that fouled the leaves of the trees and bushes that were their foodplants. Certain Ennominae seemed particularly resistant. The stick caterpillars of Scalloped Hazel *Odontopera bidentata* (Cl.), Swallow-tailed *Ourapteryx*

sambucaria (L.) and Willow Beauty *Peribatodes rhomboidaria* (D.& S.) even lived on garden privet *Ligustrum ovalifolium* hedges where the semi-evergreen leaves were visibly coated with a layer of grime. Or did they actually benefit from this diet? Perhaps the coating protected them from pathogens. The potatoes in our garden never suffered from blight despite my mother being half-Irish.

So might there have been some advantages in living in these extreme conditions? Predators were less numerous than in the countryside. There were far fewer insectivorous birds: no Sedge Warblers in the canal reeds, no Whitethroats on the railway embankments. There were no flycatchers and no hirundines, just Swifts. There were no lizards and no bats. For those moths that could withstand the pollution and all the other drawbacks, these 1950s brownfield sites may have been relatively safe and also offered reduced competition when compared with the unspoilt countryside. Generalist species that could feed on a wide range of grasses and low plants, or were polyphagous on deciduous trees and shrubs, would certainly not lack for foodplants. Weeds were everywhere. Though background pollution was pervasive, at least there were few or none of the specialised insecticides and herbicides so widely used on rural farmland. However, more specialised moths were normally at a disadvantage. Needless to say, there were no footman moths Lithosiinae because there were no lichens in the Salford area at that time. Bedstraws *Galium* spp. were very scarce, so the species that depend on them were missing. For me, Common Carpet *Epirrhoe alternata* (Müller) did not live up to its vernacular name, while normally ubiquitous species like Barred Straw *Eulithis pyraliata* (D.& S.) and Green Carpet *Colstygia pectinataria* (Knoch) were absent.

For cryptic species that rested more or less openly, it clearly helped to have a melanic form that matched the soot-blackened trunks, fences and walls. As a result, my boyhood collection was less colourful than it might have been. Melanic moths are also difficult to set without leaving unsightly scars. Despite my best efforts, even the slightest scratch or scrape showed up, particularly on otherwise pristine bred specimens. Though I realised the great scientific interest of industrial melanism and conscientiously sent my data to Bernard Kettlewell, I could not help feeling cheated that my May Highflyers *Hydriomena impluviata* (D.& S.), Peppered Moths *Biston betularia* (L.) and Green-brindled Crescents *Allophyes oxyacanthae* (L.) were always black or dark brown, thus far less attractive than their illustrations in the books. Even the caterpillars of the last were melanic. Only when I moved to Sussex did I see such species as they should have been, often so different from what I was used to that I struggled to identify them in their typical form.

No, of course I'm not nostalgic. Salford in the 1950s was a dreadful place and I couldn't wait to get away. Nevertheless, it provided a good grounding for my interest in moths. Finding them was hard work, especially without resource to modern mercury vapour light traps. There was no choice but to learn all the

traditional techniques of Victorian fieldwork. Sallowing, dusking, trunk-searching, honeydew, pupa-digging – I did them all, and many more. Even then the rewards were limited, satisfying though they were to me at the time. Subsequently I've refound virtually every species on my Salford list, usually far more easily and in greater numbers. But one of my boyhood regulars still eludes me: Small Engrailed *Ectropis crepuscularia* (D.& S.) From mid May to mid June I occasionally found its melanic form *delamerensis* White at rest on smoke-blackened tree trunks, though my records from the time grade it as 'Scarce'. I've never seen this moth since. Is it a true species? I think it is, because Engrailed *E. bistortata* (Goeze) was quite absent from the area then. Otherwise, the impoverished fauna and flora, the dirt, pollution and despoliation of 1950s Salford at least made me appreciate the species richness of the Sussex Downs and the pristine habitats of the Scottish Highlands. — ROY LEVERTON, Whitewells, Ordiquhill, Cornhill, Banffshire AB45 2HS.

ANNOUNCEMENT

ANNUAL REVIEWS OF IMMIGRANT LEPIDOPTERA

The annual reviews of immigrant Lepidoptera that appear in this journal form the permanent definitive record. Data is drawn from many sources, including other publications, and is subjected to extensive verification processes. For this latter reason in particular, publication is normally at least a year to 18 months after the close of the year being recorded. However, the direct transmission of data from the recorder on the ground to the review authors remains the preferred channel; this not only makes checking the records so much easier but also allows sharing of reports of common species that may not be mentioned in other publications. The following is the list of species which the review authors currently regard as qualifiers for inclusion. Records are wanted for all of the species as soon as possible at the end of each year, although those species marked with an asterisk (*) should only be reported from localities outside their known breeding range. Data should be sent direct to the review author Sean Clancy by e-mail to *trapsite@talktalk.net*, ideally in Excel format (xls files preferred over xlsx files), or by post to 1 Myrtle Villas, Sussex Road, New Romney TN28 8DY. **Editor**

Yponomeutidae
424 *Yponomeuta evonymella* *
428 *Yponomeuta rorrella* *

Ochsenheimeriidae
464 *Plutella xylostella*

Tortricidae
1262 *Cydia amplana*

Crambidae
1289 *Euchromius ocellea*
1291 *Haimbachia cicatricella*
1308 *Agriphila poliellus*
1311 *Catoptria osthelderi*
1317 *Catoptria verellus*
1318 *Catoptria lythargyrella*
1319 *Chrysocrambus linetella*
1320 *Chrysocrambus craterella*
1327 *Ancylolomia tentaculella*
1356a *Evergestis limbata* *
1360 *Hellula undalis*
1368 *Margaritia sticticalis*
1369 *Uresiphita polygonalis*

1372 *Paracorsia repandalis*
1374a *Sclerocona acutellus*
1383 *Psammotis pulveralis*
1384 *Phlyctaenia stachydalis* *
1389 *Udea fulvalis* *
1395 *Udea ferrugalis*
1398 *Nomophila noctuella*
1400 *Antigastra catalaunalis*
1401 *Maruca vitrata*
1402 *Diasemia reticularis*
1403 *Diasemiopsis ramburalis*
1403a *Duponchelia fovealis*
1404 *Hymenia recurvalis*
1408 *Palpita vitrealis*

Pyralidae
1435 *Conobathra tumidana*
1447 *Sciota hostilis* *
1447a *Sciota adelphella* *
1451a *Etiella zinckenella*
1464a *Zophodia grossulariella*
1466 *Mussidia nigrivenella*
1471 *Euzophera osseatella*
1472 *Euzophera bigella*
1478a *Vitula edmansii*
1478b *Vitula biviella* *

Pterophoridae
1492 *Crombruggia laetus*

Lasiocampidae
1639 *Dendrolimus pini* * Pine Tree Lappet

Drepanidae
1649 *Drepana curvatula* Dusky Hook-tip

Geometridae
1664 *Aplasta ononaria* * Rest Harrow
1672 *Thalera fimbrialis* * Sussex Emerald
1678 *Cyclophora puppillaria* Blair's Mocha
1678a *Cyclophora ruficiliaria* * Jersey Mocha
1684 *Scopula nigropunctata* * Sub-angled Wave
1688 *Scopula rubiginata* * Tawny Wave
1696 *Idaea ochrata* * Bright Wave
1716 *Rhodometra sacraria* Vestal
1720 *Orthonama obstipata* Gem
1730 *Scotopteryx peribolata* Spanish Carpet
1741 *Costaconvexa polygrammata* The Many-lined
1771a *Thera cupressata* * Cypress Carpet
1785 *Pareulype berberata* * Barberry Carpet
1815 *Eupithecia abietaria* * Cloaked Pug
1842a *Eupithecia sinuosaria* Goosefoot Pug
1855a *Eupithecia ultimaria* * Channel Islands Pug
1869 *Aplocera praeformata* Purple Treble-bar
1871 *Lithostege griseata* * Grey Carpet
1885 *Abraxas sylvata* * Clouded Magpie
1891 *Semiothisa signaria* * Dusky Peacock
1896 *Semiothisa brunneata* * Rannoch Looper
1918 *Selenia lunularia* * Lunar Thorn
1937a *Peribatodes secundaria* * Feathered Beauty
1937b *Peribatodes ilicaria* Lydd Beauty
1945 *Cleorodes lichenaria* * Brussels Lace

Sphingidae
1972 *Agrius convolvuli* Convolvulus Hawk-moth
1973 *Acherontia atropos* Death's-head Hawk-moth
1984 *Macroglossum stellatarum* Humming-bird Hawk-moth
1985 *Daphnis nerii* Oleander Hawk-moth
1986 *Hyles euphorbiae* Spurge Hawk-moth
1987 *Hyles gallii* * Bedstraw Hawk-moth
1990 *Hyles livornica* Striped Hawk-moth
1993 *Hippotion celerio* Silver-striped Hawk-moth

Notodontidae
2001 *Notodonta torva* Large Dark Prominent
2002 *Tritophia tritophus* Three-humped Prominent
2004 *Harpyia milhauseri* Tawny Prominent
2016 *Gluphisia crenata* Dusky Marbled Brown

Thaumatopoeidae
2022 *Thaumetopoea processionea* * Oak Processionary

Lymantriidae
2032 *Actornis l-nigrum* Black V Moth
2034 *Lymantria dispar* * Gypsy Moth

Arctiidae
2039 *Atolmis rubricollis* * Red-necked Footman
2051 *Lithosia quadra* * Four-spotted Footman
2053 *Coscinia cribraria* * Speckled Footman
2054 *Utetheisa pulchella* Crimson Speckled
2067 *Euplagia quadripunctaria* * Jersey Tiger

Nolidae
2079 *Nola aerugula* Scarce Black Arches

Noctuidae
2080 *Euxoa obelisca* * Square-spot Dart
2083 *Euxoa cursoria* * Coast Dart
2090 *Agrotis trux* * Crescent Dart
2091 *Agrotis ipsilon* Dark Sword-grass
2094 *Agrotis crassa* Great Dart
2097 *Actinotia polyodon* Purple Cloud
2097a *Chloantha hyperici* Pale Shouldered Cloud
2099 *Actebia praecox* * Portland Moth
2100 *Actebia fennica* Eversmann's Rustic
2101 *Ochropleura flammatra* Black Collar
2102a *Ochropleura leucogaster* Radford's Flame Shoulder

2106 *Rhyacia lucipeta* Southern Rustic
2111a *Noctua janthina* *Langmaid's Yellow Underwing
2113 *Spaelotis ravida* Stout Dart
2119 *Peridroma saucia* Pearly Underwing
2137 *Eurois occulta* * Great Brocade
2148 *Polia bombycina* * Pale Shining Brown
2160a *Lacanobia splendens* Splendid Brocade
2183 *Orthosia miniosa* * Blossom Underwing
2194 *Mythimna albipuncta* * White-point
2195 *Mythimna vitellina* Delicate
2203 *Mythimna unipuncta* * White-speck
2208 *Harpyia loreyi* Cosmopolitan
2220 *Cucullia scrophulariae* Water Betony
2233 *Lithomoia solidaginis* * Golden-rod Brindle
2238 *Lithophane furcifera* Conformist
2239 *Lithaphane lamda* Nonconformist
2241 *Xylena vetusta* * Red Sword-grass
2242 *Xylena exsoleta* * Sword-grass
2251 *Trigonophora flammea* Flame Brocade
2261 *Conistra erythocephala* Red-headed Chestnut
2285 *Acronicta strigosa* Marsh Dagger
2287 *Acronicta auricoma* Scarce Dagger
2292 *Cryphia algae* * Tree-lichen Beauty
2294 *Cryphia raptricula* Marbled Grey
2296 *Tathorrhynchus exsiccata* Levant Blackneck
2304 *Trachea atriplicis* Orache Moth
2308 *Callopistria juventina* Latin
2309 *Methorasa latreillei* * Latreille's Latin
2310a *Eucarta virgo* Silvery Gem
2313 *Enargia paleacea* * Angle-striped Sallow
2347 *Chortodes extrema* * Concolorous
2349 *Chortodes fluxa* * Mere Wainscot
2355 *Luperina dumerilii* Dumeril's Rustic
2357 *Amphipoea lucens* * Large Ear
2376 *Sedina buettneri* * Blair's Wainscot
2383 *Hoplodrina superstes* Powdered Rustic
2385 *Spodoptera exigua* Small Mottled Willow
2386 *Spodoptera littoralis* Mediterranean Brocade
2386c *Spodoptera cilium* Dark Mottled Willow
2387a *Platyperigea kadenii* * Clancy's Rustic
2388 *Paradrina flavirena* Lorimer's Rustic
2392a *Athetis hospes* Porters Rustic
2400 *Helicoverpa armigera* Scarce Bordered Straw
2401 *Heliothis viriplaca* * Marbled Clover
2402 *Heliothis maritima* * Shoulder-striped Clover
2403 *Heliothis peltigera* Bordered Straw
2404 *Heliothis nubigera* Eastern Bordered Straw
2405 *Protoschinia scutosa* Spotted Clover Moth
2407 *Eublemma ostrina* Purple Marbled
2407a *Eublemma purpurina* Beautiful Marbled
2408 *Eublemma parva* Small Marbled
2411 *Deltote deceptoria* Pretty Marbled
2413 *Deltote bankiana* * Silver Barred
2413a *Pseudeustrotia candidula* Shining Marbled
2415 *Acontia lucida* Pale Shoulder
2419 *Earias biplaga* Spiny Bollworm
2420 *Earias insulana* Egyptian Bollworm
2420a *Earias vittella* Eastern Bollworm
2423a *Nycteola asiatica* Eastern Nycteoline
2428 *Chrysodeixis chalcites* Golden Twin-spot
2429 *Chrysodeixes acuta* Tunbridge Wells Gem
2430 *Ctenoplusia limbirena* Scar Bank Gem
2431 *Ctenoplusia accentifera* Accent Gem
2432 *Trichoplusia ni* Ni Moth
2433 *Diachrysia orichalcea* Slender Burnished Brass
2436 *Macdunnoughia confusa* Dewick's Plusia
2441 *Autographa gamma* Silver Y
2444 *Autographa bractea* * Gold Spangle
2445 *Autographa biloba* Stephens' Gem
2447 *Syngrapha interrogationis** Scarce Silver Y
2448 *Syngrapha circumflexa* Essex Y
2451 *Catocala fraxini* Clifden Nonpareil
2453 *Catocala electa* Rosy Underwing
2454 *Catocala promissa* * Light Crimson Underwing
2455 *Catocala sponsa* * Dark Crimson Underwing
2456 *Minucia lunaris* Lunar Double-stripe
2460 *Dysgonia algira* Passenger
2461 *Grammodes stolida* Geometrician
2464 *Catephia alchymista* Alchymist
2464a *Aedia leucomelas* Sorcerer
2465 *Tyta luctuosa* * Four-spotted
2475 *Parascotia fuliginaria* * Waved Black
2476 *Hypena crassalis* * Beautiful Snout
2478 *Hypena obsitalis* * Bloxworth Snout
2479 *Hypena obesalis* Paignton Snout
2488a *Pechipogo plumigeralis* Plumed Fan-foot
2490 *Zanclognatha lunalis* Jubilee Fan-foot
2491a *Zanclognatha zelleralis* Dusky Fan-foot
2491 *Herminia tarsicrinalis* * Shaded Fan-foot
2495 *Trisateles emortualis* * Olive Crescent

SOCIETY MATTERS

AES AGM AND MEMBERS' DAY
28th APRIL, 2012

MANCHESTER MUSEUM

UNIVERSITY OF MANCHESTER, OXFORD ROAD, MANCHESTER M13 9PL

Manchester Museum houses the third largest entomological collection in the UK, second only to the Natural History Museum and the Hope Collections at Oxford, with unique coverage of some taxa.

As part of our AGM and annual Members' Day arrangements, the curator of entomology at Manchester, Dr Dmitri Logunov, has arranged for work areas and facilities to be available to us along with access to the collections for the entire AES members' weekend. Members' Day is on Saturday 28th April (see below) and the collections and microscopes will be available all day. Anyone wishing to use the collections the previous day or the following day should contact Dmitri, who is happy to come in on those days to enable access to the collections. For further information on the collections and access arrangements on the Friday or Sunday of the Members' Day weekend, Dmitri's email address is Dmitri.V.Logunov@manchester.ac.uk.

Members' Day Programme

In addition to accessing the collections we have arranged a programme of talks, events and museum tours for members and their guests. This year's Leonard Tesch lecture will be delivered by Dr Margaret Redfern, of the University of Sheffield, author of the New Naturalist book and other titles on plant galls. Other speakers are Drs Peter Brown and Helen Roy from Cambridge and Paul Richards from the Sheffield Museum. (We also hope to be able to squeeze in two other speakers who have expressed an interest to present on the day!).

Alongside this event we will be participating in a museum wide entomological extravaganza, entitled 'Minibeasts and Us' which is an outreach event aimed at satisfying the voracious appetite that some local families have for the Manchester Museum, and for insects! This will include activities aimed at the next generation of naturalists, with live insect handling, a bug hunt in the museum allotment, craft activities for the very young, displays by local entomological societies and the Freshwater Biological Association – and more!

Call it the effect of climate change if you will but we are very excited that this year we will be venturing northwards for our AGM and Members' Day, and we hope that as many members as possible will be able to come along to enjoy the day and to see what this excellent entomological museum has to offer. The Society is very keen to help foster an engagement with entomology in the north west, and any members wishing to

volunteer to help during the day with the public outreach side of the event would be very welcome, either explaining entomology to visitors at the displays, supervising the craft activities or in any other way. As usual there will be refreshments available in a private members' room adjacent to the lecture room, which seats 120.

NOTICE OF AES AGM

This year's AGM will take place on 28th April at the Manchester Museum, University of Manchester, Oxford Road, Manchester M13 9PL, commencing at 12:00 midday. The following members will retire from the AES Council by rotation at the AGM: Peter Hodge; John Howells; Wayne Jarvis; Dr David Lonsdale; Dr Kieren Pitts. Of these, Peter Hodge, Wayne Jarvis, David Lonsdale and Kieren Pitts have expressed their willingness to remain on Council if duly nominated and elected. Mr Ralph Hobbs was co-opted to the AES Council in December and will therefore also stand for election at the AGM, as will potential new Council members Messrs Dave Budworth and Gary Needham.

Our President, Mr Peter Hodge, has agreed to accept Council's nomination to remain as AES President for the further period April 2011 – April 2012. Additional nominations for Council membership and positions are invited in advance of the AGM or on the day. Members wishing to find out what Council membership involves should contact the Hon. Secretary or any Council member.

AES NEWSLETTER

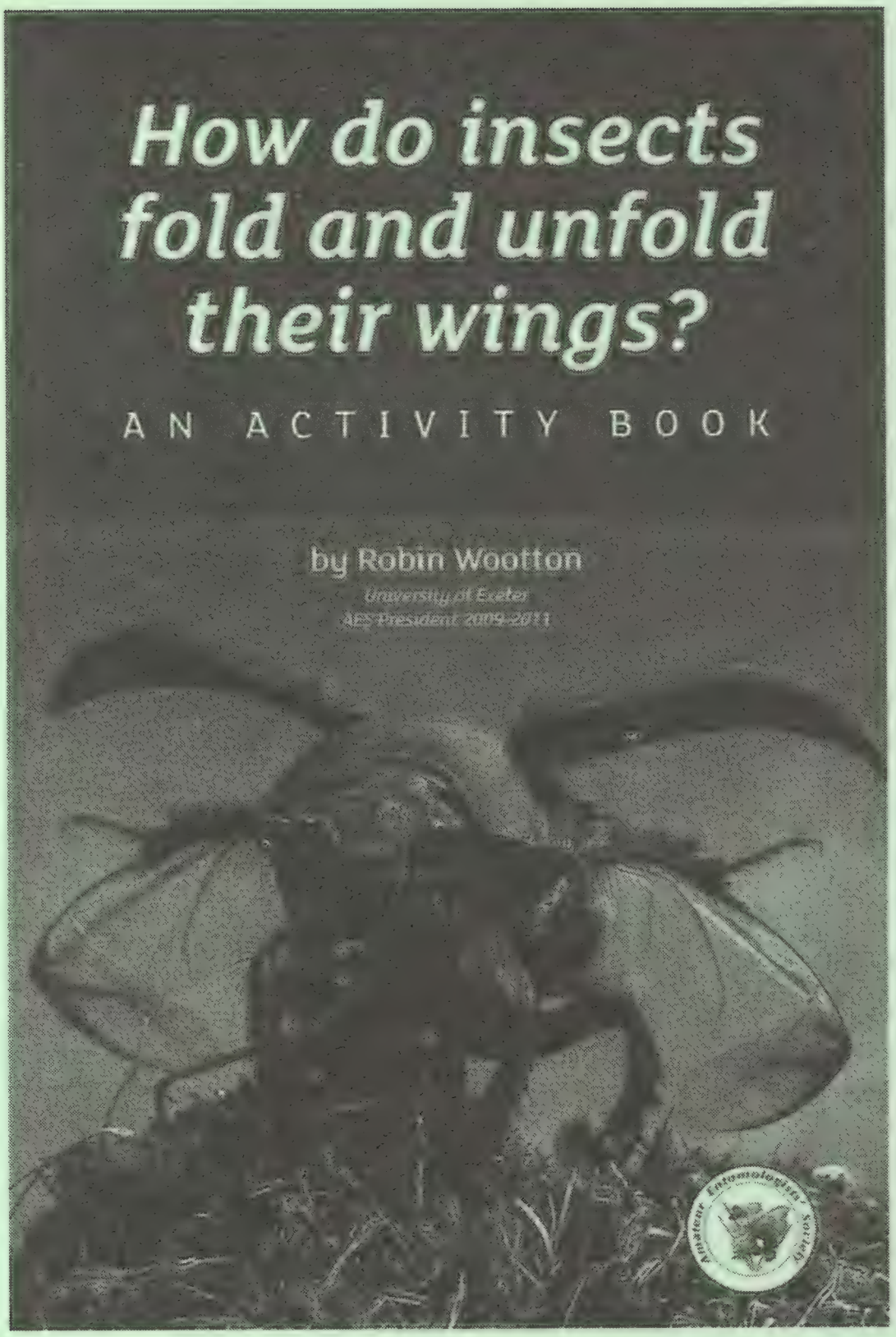
Members are reminded that in order to receive the electronic AES Newsletter they should sign up for it on the website www.amentsoc.org/newsletter/signup. Members wishing to receive advice on internet or email access or wishing to receive a paper copy of the Newsletter should contact the Hon. Secretary.

THE HAMMOND AWARD

Members are reminded that articles published in the AES Bulletin are considered for this award, which was initiated in March 1982 in memory of Cyril O. Hammond (of Colyer and Hammond fame). The Award is given for the best contribution to the *AES Bulletin* on the theme of British Insects, in any one year. The winner will receive a Certificate and £100, presented at the AGM.

DATA PROTECTION ACT

Please note that any personal information supplied to the Society is treated in accord with the requirements of current data protection legislation and will be used only for the purposes of administering the Society. We will not divulge personal information to any third party unless legally obliged to do so. The possibility of publishing a membership list is being considered but there are no plans to issue such a list during this membership year.



Insect wings do not have muscles.

How do they fold and unfold them?

This new book from the AES explains how!

This activity book by Dr Robin Wootton of Exeter University is the first of its kind to address the question of how insects fold and unfold their wings.

Robin has been studying insect flight for some 35 years. He is a Past-President of the AES and an Honorary Fellow of the Royal Entomological Society.

The book is currently available at a special price to members of £3.50 post free (price to non-members: £4.92).

Cheques should be made payable to AES Publications and sent to:
AES Publications, 1 Tower Hill, Brentwood, Essex, CM14 4TA

Or the book may be purchased through the AES online shop
http://shop.amentsoc.org/

AES Membership Rates 2012

Membership of the Society runs from 1st January to 31st December each year. New members will receive all publications published during the year of enrolment subject to availability, except for those joining on or after 1st October.

Any member joining on or after 1st October will be deemed to have joined for the following year unless he or she specifically requests membership for the current year. If such a request is made, the publications already published that year will be sent with the enrolment confirmation letter and the remaining ones will be sent when they are published. A further membership subscription will be necessary for the following year.

If you have any queries about membership please contact us via the website, www.amentsoc.org or PO Box 8774, London SW7 5ZG

Individual Adult Membership

Membership sub-category	UK	Overseas
Bulletin only	£20.00	£25.00
Entomologist's Record only	£25.00	£30.00
Bug Club Magazine only	£20.00	£25.00

Individual Bug Club / Junior Membership

Membership sub-category	UK	Overseas
Junior under-18 (*Bug Club Magazine* only)	£12.00	£17.00
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THE IMPORTANCE OF BROWNFIELD SITES FOR MOTHS: MOTHS OF NOSTERFIELD LOCAL NATURE RESERVE IN NORTH YORKSHIRE

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Abstract

The moth (Lepidoptera) fauna of Nosterfield Local Nature Reserve is examined for the years 2001 to 2011. The reserve is a former mineral extraction site upon which the vegetation has been allowed to regenerate naturally. A total of 420 moth species are recorded and the majority are now resident on the site. The results of the survey are discussed.

Keywords: Yorkshire, Nosterfield, natural regeneration, Brownfield habitat, Lepidoptera.

Introduction

Situated in the Southern Magnesian Limestone "Natural Area" (see *www.naturalengland.org.uk/ourwork/conservation/biodiversity/englands/naturalareas.aspx*), which runs as a narrow strip from Bedale in North Yorkshire down to Nottinghamshire, Nosterfield Local Nature Reserve covers 56 hectares and was once part of the arable landscape which now surrounds it. Extraction for fluvio-glacial sand and gravel commenced in the 1950s and continued until the mid 1990s, when the stocks were nearing exhaustion. This extraction process exposed some of the underlying limestone, offering tantalising opportunities for the natural regeneration of plant and invertebrate communities, in addition to areas already restored to agriculture, that presented an opportunity for some level of income through environmental stewardship schemes.

In 1993 the existing Nosterfield Gravel Pit was designated as a Site of Importance for Nature Conservation (SINC) with North Yorkshire County Council citing it as "the best site within the northern half of the county for passage and wintering waders." The following year, an application to use the worked-out site as a waste disposal facility was refused, opening the door for a conservation body to take over. The Lower Ure Conservation Trust (LUCT) was formed for this purpose in 1996. The following year, Hambleton District Council (HDC) agreed to support the designation of a Local Nature Reserve and in the autumn of 1997, Yorventure (via the Landfill Tax Credit Scheme) agreed the majority of the funding for the purchase the first 29 hectares.

From Neolithic to Nature Reserve

The ancient history of the Nosterfield area has become a matter for detailed research by several universities. The extensive gravel deposits in the area were laid down predominantly during the latter part of the last Ice Age, being particularly prolific around Nosterfield and its adjacent villages. Also in the area

lies a line of three large "henges" – the Thornborough monument complex. Detailed archaeological and geological research has indicated that the area to the east was mainly wooded during the Neolithic period, but with an extensive swamp to the north. The latter was a former reed *Phragmites* and sedge *Carex* -fringed, post-glacial lake. Changes in the course of the nearby River Ure and drainage of the swamp by the Romans brought significant changes to the surrounding landscape and by the 13th century there was evidence of management for peat digging and hay meadows. Lastly, the arrival of the railways and mechanisation heralded increasing sand and gravel extraction.

The long agricultural history of the Nosterfield (translating as "sheep field") area, dating back to Neolithic times, has underpinned management to primarily enhance wet grassland habitats which were already developing on the site. To focus the management priorities of the new reserve, primary objectives were formulated which were to improve the habitat for breeding populations of Shoveler *Anas clypeata* and Redshank *Tringa totanus*, but also for passage and wintering waterfowl and waders; where wet grassland could not be readily achieved, emphasis was placed on natural regeneration of the old Silt Lagoons, by the encouragement of naturally developing plant and insect communities.

Main Habitats

The site can conveniently be divided up into three main compartments: Main Lake and Sheep Field (including the railway embankment); the West and East Silt Lagoons and the North Lake (including Orchid and Musk Thistle Fields). The reserve acts as an 'oasis' in the local area, being surrounded by large arable fields to the north, improved grazing land to the east and south, sandwiched between two villages to east and west, with a working quarry to the north.

It should be noted that there is no control over the water level on the site; this is entirely dependent on naturally occurring, seasonal 'springs' located at the base of the north-west/south-east running Magnesian Limestone ridge, existing groundwater levels and precipitation. This unusual situation results in a large water level fluctuation during the year, which can be as great as three metres, resulting in the creation of a unique 'draw-down zone' around the margins of the Main Lake.

Main Lake and Sheep Field

The largest compartment of the three (approx 29 hectares) and predominantly neutral grassland, it surrounds the largest water body on the site. This 'lowland wet grassland' is now an extremely rare habitat in the Hambleton District of North Yorkshire. It is managed under a Higher Level Stewardship Agreement with Natural England, being selectively grazed in the autumn months to make it an attractive breeding area for the target bird species. Thus, a very distinctive plant community has developed, containing some unusual species such as Mudwort

Limosella aquatica, amongst a wider range of draw-down zone species including the oraches *Atriplex* spp., which possibly encourage *Coleoptera versurella* within its favoured open habitat.

Key plant species on the slightly higher ground include a wide variety of grasses, Red Bartsia *Odontites vernus*, Yellow-rattle *Rhinanthus minor*, vetches *Vicia* spp. and clovers *Trifolium* spp., the latter supporting a strong population of Shaded Broad-bar *Scotopteryx chenopodiata.* The Brown-line Bright-eye *Mythimna conigera* apparently flourishes in this area and the occurrence of Smooth Hawk's-beard *Crepsis capillaris* has resulted in regular records of Broad-barred White *Hecatera bicolorata.* Why the Nationally Scarce (Category Nb) Plain Clay *Eugnorisma depuncta* appears to thrive on the surrounding Magnesian Limestone belt remains something of a mystery; however, a healthy population exists on the reserve and there is a wide range of 'low-growing herbaceous species such as dock' which form the larval pabulum. These include, incidentally, the local and uncommon Golden Dock *Rumex maritimus.*

The embankment of a disused railway (also a brownfield site) which forms the western boundary of the reserve is typical of those where the peripheral vegetation has been allowed to grow unchecked. It is dominated by self-seeded Ash *Fraxinus excelsior* saplings, with Oak *Quercus robur* and Bramble *Rubus fruticosus* agg.

Whilst moth-trapping data is inevitably confused by local wanderers, possibly from the northerly wooded hedge to the east, it seem probable that this latter area is supporting species such as *Pammene giganteana* which feeds on oak apple and other spongy galls. Remaining boundary hedges after mineral extraction were thin and relatively species-poor; it seems that the introduction of local provenance Field Maple *Acer campestris* may have artificially boosted the local Maple Pug *Eupithecia tenuiata* population, this species having been fairly regularly recorded since 2004. Wych Elm *Ulmus glabra* in these hedgerows (and elsewhere in scrubby areas on the reserve), attracts the White-letter Hairstreak butterfly *Satyrium w-album* and probably accounts for the occurrence of Dusky-lemon Sallow *Xanthia gilvago* in more recent times.

West and East Silt Lagoons

These are two adjoining ponds, where the "washings" from the quarry plant were pumped. Gravel washing results in the larger sand particles being deposited closest to the outlet, with finer clay particles travelling further; on the reserve, this has created almost heath-like, dry, sandy conditions on higher ground, with more of a clay-silt on the lower saturated ground encouraging wetland species to colonise.

A steep gravel bank forms the southern boundary to this area, on top of which the permissive footpath provides a suitable viewing point. The bank, rising sharply from the water's edge to the path, was originally planted by the quarry company using shrubs of local native provenance, but their growth has been slow. However, this is the reserve's only site for Hemp Agrimony *Eupatorium*

cannabinum, which supports the plume moth *Adaina microdactyla*. In contrast, the gravel banks on the opposite side of the path, sheltered from the road by a mature hedgerow, have developed a very varied flora including small Gorse *Ulex europaeus* bushes, Ox-eye Daisies *Leucanthemum vulgare*, Cowslip *Primula veris*, Dove's-foot Crane's-bill *Geranium molle*, Ploughman's-spikenard *Inula conyzae* and a number of grasses. This area is particularly favoured by butterflies such as the Common Blue *Polyommatus icarus* and Brown Argus *Aricia agestis*, the latter a recent colonist.

On completion of quarrying, the Silt Lagoon area had a barren, almost moon-like appearance (Plate 8), with only scattered vegetation and mosses surviving. The restoration manager of the quarry company was keen to sow a grass seed mixture over this area (the "quick fix" approach) which had been specifically developed for this purpose. However, LUCT adhered to its principles of natural regeneration, in the face of some local concern. This has resulted in extensive beds of Marsh *Equisetum palustre* and Giant Horsetail *E. telmataeia* on the lower, wetter ground, sparse amounts of Common Reed *Phragmites australis* and Greater Pond Sedge *Carex riparia* around the water margins and an encouraging mix of limestone grassland species on the drier areas, including Yellow-wort *Blackstonia perfoliata*, Teasel *Dipsacus fullonum* and Ragwort *Senecio jacobaea*. The latter is a familiar colonist of recently excavated sites and there was much local pressure to eradicate this native species from the reserve. LUCT developed its own 'Ragwort Management Plan' and controls the growth of Ragwort where stock graze, but a core area is maintained in the Silt Lagoons, resulting in a healthy colony of the Cinnabar *Tyria jacobaeae*. The open grassland is grazed by a small population of Rabbits *Oryctolagus cuniculus*, which occupy a warren excavated into the sandy substrate, thus maintaining a relatively low sward height.

The Silt Lagoons have produced the most diverse and more unusual species of moth recorded on the whole reserve. Associated with the drier, sandy areas are *Depressaria badiella, Aproaerema anthyllidella, Cochylis roseana* (on Teasel), Tawny Shears *Hadena perplexa* and White-line Dart *Euxoa tritici*. In contrast, those associated with the wetter habitat include *Elachista maculicerusella*, *Metendothenia atropunctana*, *Chilo phragmitella*, *Catoptria pinella* and *Eudonia pallida*. The colonisation of the lagoon area by Ploughman's-spikenard *Inula conyzae*, most probably from the nearby henges, has proved attractive to the plume moth *Euleioptilus carphodactyla* and the influence of the Magnesian Limestone has proved attractive to the White-marked *Cerastis leucographa*. Lastly, a more recent colonist into the area is Southern Wainscot *Mythimna straminea*, associated with *Phragmites* and *Phalaris*.

North Lake

This is a smaller water body, where considerable re-profiling work was undertaken by LUCT, to soften the unnaturally straight edges to the lake; it is

open on all aspects except to the north, where a barrier of semi-mature, regularly coppiced willows *Salix* spp. provide some shelter. To access a viewing screen which overlooks this lake, it was necessary to create screening bunds on both sides of the footpath (using subsoil from other works). During the last 15 years, these bunds have developed their own flora, including locally rare species such as Bladder Campion *Silene vulgaris*, foodplant of the distinctive and extremely local Netted Pug *Eupithecia venosata.*

Survey Methods

Surveys of Nosterfield LNR were initiated early in the formation of the reserve in order to monitor and record changes as the site developed. Initially this was an insect survey (Crossley, 1998. *Nosterfield Nature Reserve – Ecological Census Insect Survey*. Unpublished report to Lower Ure Conservation Trust) focussing particularly on the Diptera, followed by a thorough botanical survey (Millward, 1998. *Botanical Report for Nosterfield Nature Reserve*). Miscellaneous records had been published in the annual reports of a local natural history society (Harrogate & District Naturalists' Society, 1975 to present) and with the construction of the Main Hide in 2000/2001, the provision of a "log book" encouraged regular records of all orders from the volunteer workforce and visitors. Data from the log sheets is stored electronically, using MapMate software, for onward transmission to the local and county recorders; Lepidoptera and Odonata records are also actively encouraged from those who are confident with their identification.

Moth trapping has been carried out on site since 2001, using two Honda generators running four or five mercury vapour 125w light traps all night around the periphery of the Reserve. For the first six years, because of the open nature of the site, there were concerns about the safety of the equipment. The moth trappers therefore spent the night in the fairly basic accommodation of the main hide and less trapping resulted. More recently, it was decided to "take the risk", chaining the generators to immoveable objects and switching off at dawn, which has seen a steady increase in trapping activity, now averaging six or seven times a year.

The peak moth trapping season coincides with the main bird breeding season and because the reserve regularly hosts at least six species of breeding waders (two of which are Wildlife & Countryside Act Schedule 1 species), there is no access to the main body of the site during this period. In late July, when the grazing animals are brought in, moth trapping is confined to the areas of the Silt Lagoons, North Lake and Railway Embankment, where the stock cannot gain access.

The list of moths so far recorded at Nosterfield Local Nature Reserve is presented in Table 1.

Site Management

From the outset, when LUCT acquired the site, there was a purposeful move away from artificial habitat creation, the "soil it, seed it" mantra that is so prevalent in

many quarry restorations, towards allowing natural regeneration from the existing seed bank. The large subsoil piles which had been on site for several years, were not regularly sprayed with weed killer, so resulting in the development of natural plant communities. These in turn offered an immediate source of seed when the subsoil was subsequently spread out over areas specified by LUCT.

Only the most necessary planting, such as to form screening around the main car park and along the permissive footpath, was undertaken in the early restoration stage, using woody species such as Hawthorn *Crataegus monogyna*, Blackthorn *Prunus spinosa*, Dog-rose *Rosa canina*, Holly *Ilex aquifolium* and the locally occurring speciality Spindle *Euonymous europaeus*, all sourced from native stock. These have now matured well into effective barriers and possibly increased the populations of many leaf-mining moths in families Nepticulidae, Gracillariidae and others.

Grazing

The management of the greater core of the reserve is by grazing animals – a mixture of cattle (around 15 animals) and sheep, to give a varied sward to the grassland, which in turn is both attractive to wintering waterfowl and the key breeding species – Redshank and Shoveler; a hay-cut is taken over about 10 hectares, followed by extensive grazing from mid-July until the late autumn.

Discussion

An overall total of 420 moth taxa has been recorded at the site in the period 2001 to 2011 (Table 1). Of these, 293 (about 75%) are classified as "macros" indicating that there remains an element of specialist recording still to be undertaken here. This list does not segregate several species aggregates (e.g., *Mesapamea secalis/secalella* and *Acronicta psi/tridens*); this is partly because data is either unavailable or potentially unreliable. Nevertheless, the list is probably representative of the overall nature of the moth fauna that has colonised the site since its creation.

In terms of site ecology, of course, it is only the resident species that truly matter. Immigrant moths recorded during the ten year period have included predictable species such as Diamond-backed Moth *Plutella xylostella*, Rusty-dot Pearl *Udea ferrugalis*, Rush Veneer *Nomophila noctuella*, Silver Y *Autographa gamma* and Dark Sword-grass *Agrotis ipsilon* as well as less frequent visitors such as Small Mottled Willow *Spodoptera exigua*. These are clearly irrelevant in terms of interpretation of site ecology, as their arrival is governed by more distant parameters. Similarly, vagrant species such as the Red Carpet *Xanthorhoe decoloraria*, presumably a wanderer from higher ground nearby, can be dismissed as far as interpretation of the list is concerned.

On the other hand, it is pleasing to note that since moth recording started in 2001, no less than 14 species have been newly recorded for the Vice-county (VC

65: North-west Yorkshire) on the reserve. These are all "micros" and are indicated in Table 1. It is clear that brownfield sites such as this have a significant role to play in the support of moth biodiversity. There is a long history of sand and gravel extraction in North Yorkshire, but there appears to be a distinct paucity of quality invertebrate survey data available to guide policy makers and planners for the sensitive restoration of such mineral sites. Even taking into consideration the fact that Nosterfield LNR is managed with the key aim of attracting particular species of declining British bird to breed, the LUCT policy of "let nature take its course" combined with sensitive and thoughtful management practices has greatly increased the moth diversity of the reserve. Detailed invertebrate and plant surveys that have been undertaken from an early stage will be repeated at regular intervals during the maturation of the site, thus fully documenting its ecological development. The recent commissioning and publication of a thorough invertebrate survey (Hammond, 2010, available at *www.luct.org.uk/wp-content/uploads/2011/04/NNR-Invertebrate-Survey-2009-to-2010-Martin-Hammond.pdf*), incorporating both new survey data and older records, has been extremely revealing and even since its publication, an additional 13 species of moth have been recorded.

Table 1. Moths Recorded at Nosterfield Local Nature Reserve 2001 – 2011.

Names follow Bradley (2000) and the code numbers are given; to save space, therefore, the authorities are omitted. An asterisk indicates a new species for VC 65.

		Records	First Recorded	Last Recorded
	Eriocraniidae			
6	*Eriocrania subpurpurella*	2	2002	2005
	Hepialidae			
14	*Hepialus humuli*	2	2010	2011
15	*Hepialus sylvina*	2	2011	2011
17	*Hepialus lupulinus*	8	2007	2011
18	*Hepialus fusconebulosa*	5	2001	2011
	Nepticulidae			
29	*Ectoedemia atricollis*	1	2002	2002
37	*Ectoedemia albifasciella*	1	2011	2011
50	*Stigmella aurella*	3	2002	2006
67	*Stigmella plagicolella*	2	2002	2002
68	*Stigmella salicis*	1	2011	2011
75	*Stigmella floslactella*	1	2011	2011
79	*Stigmella perpygmaeella*	1	2011	2011
80	*Stigmella ulmivora*	2	2011	2011
81	*Stigmella hemargyrella*	1	2002	2002
99	*Stigmella hybnerella*	2	2002	2011
100	*Stigmella oxyacanthella*	2	2011	2011
111	*Stigmella microtheriella*	1	2011	2011
	Zygaenidae			
169	*Zygaena filipendulae*	7	2005	2011
171	*Zygaena lonicerae*	5	2006	2009
	Tineidae			
246	*Tinea semifulvella*	1	2010	2010
247	*Tinea trinotella*	1	2010	2010
	Lyonetiidae			
260	*Leucoptera malifoliella*	1	2002	2002
263	*Lyonetia clerkella*	3	2002	2011
	Gracillariidae			
303	*Parornix anglicella*	3	2002	2004
304	*Parornix devoniella*	2	2011	2011
308	*Parornix finitimella* *	2	2009	2010
310	*Callisto denticulella*	1	2011	2011
323	*Phyllonorycter oxyacanthae*	2	2002	2002
326	*Phyllonorycter blancardella*	1	2011	2011
341	*Phyllonorycter maestingella*	1	2002	2002
342	*Phyllonorycter coryli*	2	2011	2011
356	*Phyllonorycter tristrigella*	1	2011	2011
364	*Phyllonorycter geniculella*	1	2010	2010
	Glyphipterigidae			
391	*Glyphipterix simpliciella*	2	2007	2009
	Yponomeutidae			
411	*Argyresthia goedartella*	1	2004	2004
420	*Argyresthia pruniella*	1	2011	2011
421	*Argyresthia bonnetella*	1	2004	2004
424	*Yponomeuta evonymella*	5	2001	2011
425	*Yponomeuta padella*	1	2001	2001
436	*Pseudoswammerdamia combinella*	2	2010	2011
437	*Swammerdamia caesiella*	1	2011	2011
441	*Paraswammerdamia nebulella*	1	2001	2001
449	*Prays fraxinella*	2	2010	2011

		Records	First Recorded	Last Recorded
449	*Prays fraxinella f. rustica*	2	2009	2011
464	*Plutella xylostella*	8	2001	2011
465	*Plutella porrectella*	1	2011	2011
	Coleophoiridae			
518	*Coleophora mayrella*	6	2007	2011
536	*Coleophora betulella* *	1	2001	2001
544	*Coleophora albicosta*	4	2007	2010
553	*Coleophora striatipennella*	3	2007	2010
559	*Coleophora peribenanderi*	1	2011	2011
565	*Coleophora saxicolella*	1	2011	2011
568	*Coleophora versurella* *	1	2010	2010
582	*Coleophora glaucicolella*	1	2010	2010
587	*Coleophora caespititiella*	1	2007	2007
	Elachistidae			
597	*Elachista atricomella*	4	2001	2011
607	*Elachista canapennella*	7	2004	2011
609	*Elachista maculicerusella* *	1	2004	2004
610	*Elachista argentella*	2	2001	2011
	Oecophoridae			
647	*Hofmannophila pseudospretella*	2	2001	2010
648	*Endrosis sarcitrella*	2	2010	2011
658	*Carcina quercana*	1	2001	2001
	Chimabachidae			
663	*Diurnea fagella*	3	2003	2011
	Depressariidae			
672	*Depressaria heraclei*	1	2009	2009
674	*Depressaria badiella* *	2	2010	2011
697	*Agonopterix arenella*	3	2003	2009
	Gelechiidae			
724	*Metzneria lappella*	3	2007	2011
726	*Metzneria metzneriella*	2	2010	2010
779	*Bryotropha affinis*	1	2009	2009
787	*Bryotropha terrella*	2	2010	2011
830	*Caryocolum fraternella*	2	2009	2011
843	*Aproaerema anthyllidella* *	2	2004	2009
855	*Acompsia cinerella*	3	2011	2011
868	*Helcystogramma rufescens*	6	2001	2011
	Blastobasidae			
873	*Blastobasis adustella*	5	2001	2011
874	*Blastobasis lacticolella*	2	2010	2011
	Momphidae			
883	*Mompha raschkiella*	2	2010	2011
886	*Mompha ochraceella*	2	2010	2011
892	*Mompha subbistrigella*	4	2002	2010
893	*Mompha epilobiella*	4	2007	2010
	Cosmnopterigidae			
905	*Blastodacna hellerella*	2	2010	2011
	Tortricidae			
937	*Agapeta hamana*	13	2001	2011
938	*Agapeta zoegana*	4	2001	2011
946	*Aethes rubigana*	1	2011	2011
947	*Aethes smeathmanniana*	1	2004	2004
962	*Cochylis roseana* *	1	2001	2001
966	*Cochylis atricapitana*	9	2007	2011
969	*Pandemis corylana*	1	2011	2011
970	*Pandemis cerasana*	2	2010	2011
972	*Pandemis heparana*	3	2001	2011
977	*Archips podana*	3	2010	2011
986	*Syndemis musculana*	1	2011	2011
989	*Aphelia paleana*	2	2001	2010
993	*Clepsis spectrana*	4	2001	2011
994	*Clepsis consimilana*	1	2010	2010
998	*Epiphyas postvittana*	1	2009	2009
1000	*Ptycholoma lecheana*	1	2007	2007
1001	*Lozotaeniodes formosanus*	1	2004	2004
1011	*Pseudargyrotoza conwagana*	2	2010	2011
1016	*Cnephasia longana*	3	2004	2011
1020	*Cnephasia stephensiana*	2	2001	2011
1024	*Cnephasia incertana*	1	2001	2001
1029	*Eana osseana*	1	2011	2011
1036	*Acleris forsskaleana*	3	2001	2011
1037	*Acleris holmiana*	1	2001	2001
1038	*Acleris laterana*	1	2010	2010
1038x	*Acleris laterana/comariana*	1	2009	2009
1041	*Acleris sparsana*	1	2011	2011
1042	*Acleris rhombana*	3	2001	2011
1048	*Acleris variegana*	4	2010	2011
1062	*Acleris emargana*	1	2010	2010
1063	*Celypha striana*	12	2001	2011
1076	*Celypha lacunana*	9	2007	2011
1082	*Hedya pruniana*	7	2007	2011
1083	*Hedya nubiferana*	5	2001	2011
1084	*Hedya ochroleucana* *	1	2010	2010
1085	*Metendothenia atropunctana* *	1	2001	2001
1108	*Lobesia abscisana*	3	2011	2011
1109	*Lobesia littoralis*	1	2004	2004
1111	*Bactra lancealana*	2	2010	2011
1115	*Ancylis achatana*	3	2010	2011
1126	*Ancylis badiana*	2	2010	2010
1133	*Epinotia bilunana*	1	2007	2007
1138	*Epinotia nisella*	1	2011	2011
1139	*Epinotia tenerana*	1	2011	2011
1169	*Gypsonoma dealbana*	1	2010	2010
1174	*Epiblema cynosbatella*	4	2007	2011
1175	*Epiblema uddmanniana*	8	2001	2011
1176	*Epiblema trimaculana*	3	2007	2010
1178	*Epiblema roborana*	1	2011	2011
1197	*Eucosma campoliliana*	2	2010	2011
1201	*Eucosma cana*	10	2001	2011
1219	*Lathronympha strigana*	9	2004	2011
1227	*Pammene giganteana*	1	2011	2011
1247	*Grapholita funebrana*	2	2011	2011
1255	*Cydia ulicetana*	5	2007	2011
1260	*Cydia splendana*	1	2004	2004
1279	*Dichrorampha acuminatana*	2	2011	2011
	Crambidae			
1290	*Chilo phragmitella*	2	2007	2009
1293	*Chrysoteuchia culmella*	10	2001	2011
1294	*Crambus pascuella*	3	2010	2011
1301	*Crambus lathoniellus*	4	2008	2011
1302	*Crambus perlella*	4	2004	2011
1304	*Agriphila straminella*	9	2001	2011
1305	*Agriphila tristella*	9	2001	2011
1313	*Catoptria pinella* *	2	2001	2010
1316	*Catoptria falsella*	4	2001	2011
1331	*Acentria ephemerella*	1	2011	2011
1332	*Scoparia subfusca*	3	2001	2010

Plate 8. Silt lagoon at Nosterfield after cessation of gravel extraction in the mid-1990s.

Plate 9. The same lagoon in 2011.

		Records	First Recorded	Last Recorded			Records	First Recorded	Last Recorded
1333	*Scoparia pyralella*	7	2007	2011	1746	*Anticlea badiata*	1	2011	2011
1334	*Scoparia ambigualis*	5	2001	2011	1747	*Anticlea derivata*	1	2010	2010
1336	*Eudonia pallida*	4	2009	2011	1748	*Mesoleuca albicillata*	1	2007	2007
1338	*Dipleurina lacustrata*	5	2009	2011	1750	*Lampropteryx suffumata*	1	2011	2011
1344	*Eudonia mercurella*	3	2001	2011	1754	*Eulithis prunata*	3	2009	2011
1345	*Elophila nymphaeata*	2	2004	2007	1755	*Eulithis testata*	2	2001	2009
1356	*Evergestis forficalis*	4	2001	2011	1758	*Eulithis pyraliata*	3	2010	2011
1362	*Pyrausta purpuralis*	1	2001	2001	1759	*Ecliptopera silaceata*	3	2001	2011
1376	*Eurrhypara hortulata*	5	2010	2011	1760	*Chloroclysta siterata*	1	2009	2009
1388	*Udea lutealis*	10	2001	2011	1762	*Chloroclysta citrata*	1	2004	2004
1390	*Udea prunalis*	3	2009	2011	1764	*Chloroclysta truncata*	10	2001	2011
1392	*Udea olivalis*	3	2007	2010	1765	*Cidaria fulvata*	2	2010	2011
1395	*Udea ferrugalis*	1	2011	2011	1766	*Plemyria rubiginata*	1	2001	2001
1398	*Nomophila noctuella*	3	2004	2011	1768	*Thera obeliscata*	2	2010	2011
1405	*Pleuroptya ruralis*	7	2001	2011	1769	*Thera britannica*	5	2007	2011
	Pyralidae				1776	*Colostygia pectinataria*	13	2001	2011
1413	*Hypsopygia costalis*	3	2001	2009	1777	*Hydriomena furcata*	5	2001	2011
1415	*Orthopygia glaucinalis*	1	2010	2010	1795	*Epirrita dilutata*	1	2010	2010
1428	*Aphomia sociella*	2	2007	2010	1798	*Epirrita filigrammaria*	1	2009	2009
1439	*Trachycera advenella*	7	2001	2011	1802	*Perizoma affinitata*	1	2010	2010
1458	*Myelois circumvoluta*	11	2001	2011	1803	*Perizoma alchemillata*	3	2001	2011
1470	*Euzophera pinguis*	6	2001	2011	1808	*Perizoma flavofasciata*	2	2008	2011
1483	*Phycitodes binaevella*	1	2011	2011	1811	*Eupithecia tenuiata*	1	2011	2011
	Pterophoridae				1812	*Eupithecia inturbata*	3	2004	2011
1508	*Stenoptilia bipunctidactyla* *	2	2010	2011	1819	*Eupithecia exiguata*	5	2008	2011
1509	*Stenoptilia pterodactyla* *	1	2011	2011	1823	*Eupithecia venosata*	2	2008	2011
1513	*Pterophorus pentadactyla*	2	2010	2011	1825	*Eupithecia centaureata*	6	2004	2011
1517	*Adaina microdactyla* *	1	2011	2011	1830	*Eupithecia absinthiata*	1	2001	2001
1519	*Euleioptilus carphodactyla* *	3	2010	2011	1834	*Eupithecia vulgata*	9	2007	2011
1524	*Emmelina monodactyla*	2	2004	2011	1835	*Eupithecia tripunctaria*	1	2007	2007
	Lasiocampidae				1837	*Eupithecia subfuscata*	5	2007	2011
1640	*Euthrix potatoria*	3	2001	2011	1838	*Eupithecia icterata*	2	2001	2009
	Drepanidae				1851	*Eupithecia virgaureata*	1	2009	2009
1646	*Watsonalla binaria*	1	2010	2010	1858	*Chloroclystis v-ata*	1	2001	2001
1648	*Drepana falcataria*	1	2010	2010	1859	*Pasiphila chloerata*	1	2007	2007
1651	*Cilix glaucata*	6	2001	2010	1860	*Pasiphila rectangulata*	3	2007	2011
	Thyatiridae				1862	*Gymnoscelis rufifasciata*	1	2011	2011
1652	*Thyatira batis*	1	2010	2010	1867	*Aplocera plagiata*	5	2001	2009
1653	*Habrosyne pyritoides*	4	2009	2011	1868	*Aplocera efformata*	7	2004	2011
1654	*Tethea ocularis*	1	2010	2010	1881	*Trichopteryx carpinata*	1	2011	2011
1657	*Ochropacha duplaris*	1	2010	2010	1883	*Acasis viretata*	1	2009	2009
	Geometridae				1884	*Abraxas grossulariata*	4	2007	2011
1663	*Alsophila aescularia*	3	2003	2011	1887	*Lomaspilis marginata*	1	2010	2010
1669	*Hemithea aestivaria*	1	2011	2011	1902	*Petrophora chlorosata*	3	2007	2010
1682	*Timandra comae*	2	2007	2010	1904	*Plagodis dolabraria*	5	2007	2011
1702	*Idaea biselata*	2	2001	2011	1906	*Opisthograptis luteolata*	15	2001	2011
1708	*Idaea dimidiata*	6	2001	2011	1913	*Ennomos alniaria*	6	2001	2010
1713	*Idaea aversata*	4	2001	2011	1914	*Ennomos fuscantaria*	3	2004	2010
1722	*Xanthorhoe designata*	2	2010	2011	1917	*Selenia dentaria*	6	2001	2011
1723	*Xanthorhoe decoloraria*	1	2011	2011	1921	*Crocallis elinguaria*	2	2001	2011
1724	*Xanthorhoe spadicearia*	5	2009	2011	1922	*Ourapteryx sambucaria*	2	2011	2011
1725	*Xanthorhoe ferrugata*	5	2001	2011	1931	*Biston betularia*	6	2001	2011
1726	*Xanthorhoe quadrifasiata*	1	2011	2011	1935	*Erannis defoliaria*	1	2011	2011
1727	*Xanthorhoe montanata*	11	2005	2011	1937	*Peribatodes rhomboidaria*	7	2001	2011
1728	*Xanthorhoe fluctuata*	1	2010	2010	1941	*Alcis repandata*	4	2001	2011
1732	*Scotopteryx chenopodiata*	7	2001	2011	1947	*Ectropis bistortata*	1	2011	2011
1738	*Epirrhoe alternata*	14	2001	2011	1954	*Bupalus piniaria*	4	2001	2011
1742	*Camptogramma bilineata*	6	2001	2010	1955	*Cabera pusaria*	3	2007	2010

		Records	First Recorded	Last Recorded
1956	*Cabera exanthemata*	3	2007	2010
1958	*Lomographa temerata*	3	2010	2010
1961	*Campaea margaritata*	4	2009	2011
	Sphingidae			
1979	*Mimas tiliae*	2	2007	2008
1980	*Smerinthus ocellata*	3	2008	2010
1981	*Laothoe populi*	8	2001	2011
1991	*Deilephila elpenor*	10	2001	2011
1992	*Deilephila porcellus*	1	2008	2008
	Notodontidae			
1994	*Phalera bucephala*	4	2001	2011
1997	*Furcula furcula*	1	2011	2011
2000	*Notodonta dromedarius*	2	2009	2011
2003	*Notodonta ziczac*	7	2007	2011
2006	*Pheosia gnoma*	3	2010	2011
2007	*Pheosia tremula*	3	2001	2007
2008	*Ptilodon capucina*	4	2009	2011
2011	*Pterostoma palpina*	3	2007	2010
2020	*Diloba caeruleocephala*	1	2010	2010
	Lymantriidae			
2026	*Orgyia antiqua*	2	2008	2010
2028	*Calliteara pudibunda*	6	2007	2011
2030	*Euproctis similis*	8	2001	2011
2031	*Leucoma salicis*	2	2001	2011
	Arctiidae			
2038	*Nudaria mundana*	1	2011	2011
2050	*Eilema lurideola*	8	2001	2011
2057	*Arctia caja*	3	2001	2011
2060	*Spilosoma lubricipeda*	9	2007	2011
2061	*Spilosoma luteum*	9	2007	2011
2063	*Diaphora mendica*	2	2011	2011
2064	*Phragmatobia fuliginosa*	7	2001	2011
2069	*Tyria jacobaeae*	16	2004	2011
	Nolidae			
2077	*Nola cucullatella*	1	2011	2011
2078	*Nola confusalis*	2	2010	2010
	Noctuidae			
2081	*Euxoa tritici*	1	2011	2011
2087	*Agrotis segetum*	3	2007	2010
2088	*Agrotis clavis*	1	2010	2010
2089	*Agrotis exclamationis*	13	2001	2011
2091	*Agrotis ipsilon*	4	2001	2011
2092	*Agrotis puta*	12	2001	2011
2098	*Axylia putris*	8	2001	2011
2102	*Ochropleura plecta*	21	2001	2011
2103	*Eugnorisma depuncta*	4	2004	2011
2107	*Noctua pronuba*	18	2001	2011
2109	*Noctua comes*	9	2001	2011
2110	*Noctua fimbriata*	6	2001	2010
2111	*Noctua janthe*	7	2001	2011
2112	*Noctua interjecta caliginosa*	4	2001	2011
2118	*Lycophotia porphyrea*	1	2010	2010
2120	*Diarsia mendica*	2	2001	2010
2123	*Diarsia rubi*	17	2001	2011
2126	*Xestia c-nigrum*	17	2001	2011
2128	*Xestia triangulum*	6	2001	2011
2130	*Xestia baja*	6	2004	2011
2133	*Xestia sexstrigata*	8	2001	2011
2134	*Xestia xanthographa*	7	2001	2011
2136	*Naenia typica*	1	2011	2011
2139	*Cerastis rubricosa*	2	2003	2011
2140	*Cerastis leucographa*	1	2011	2011
2145	*Discestra trifolii*	3	2004	2011
2147	*Hada plebeja*	3	2010	2011
2154	*Mamestra brassicae*	1	2011	2011
2155	*Melanchra persicariae*	1	2001	2001
2158	*Lacanobia thalassina*	2	2010	2011
2160	*Lacanobia oleracea*	10	2001	2011
2163	*Melanchra pisi*	3	2007	2010
2164	*Hecatera bicolorata*	3	2010	2011
2166	*Hadena rivularis*	4	2001	2011
2167	*Hadena perplexa*	6	2007	2011
2173	*Hadena bicruris*	5	2009	2011
2176	*Cerapteryx graminis*	4	2001	2011
2179	*Panolis flammea*	1	2011	2011
2182	*Orthosia cruda*	3	2003	2011
2186	*Orthosia gracilis*	4	2003	2011
2187	*Orthosia cerasi*	4	2003	2011
2188	*Orthosia incerta*	4	2003	2011
2189	*Orthosia munda*	2	2011	2011
2190	*Orthosia gothica*	6	2003	2011
2192	*Mythimna conigera*	5	2001	2011
2193	*Mythimna ferrago*	10	2001	2011
2197	*Mythimna straminea*	1	2011	2011
2198	*Mythimna impura*	10	2001	2011
2199	*Mythimna pallens*	14	2001	2011
2205	*Mythimna comma*	11	2007	2011
2221	*Shargacucullia verbasci*	6	2004	2011
2227	*Asteroscopus sphinx*	1	2010	2010
2240	*Lithophane leautieri*	1	2010	2010
2243	*Xylocampa areola*	1	2011	2011
2245	*Allophyes oxyacanthae*	2	2010	2011
2247	*Dichonia aprilina*	2	2010	2011
2248	*Dryobotodes eremita*	2	2009	2010
2256	*Eupsilia transversa*	2	2011	2011
2258	*Conistra vaccinii*	2	2011	2011
2262	*Agrochola circellaris*	3	2001	2011
2263	*Agrochola lota*	2	2010	2011
2266	*Agrochola litura*	4	2001	2011
2267	*Agrochola lychnidis*	3	2010	2011
2269	*Atethmia centrago*	4	2001	2011
2270	*Omphaloscelis lunosa*	2	2010	2011
2271	*Xanthia citrago*	1	2001	2001
2272	*Xanthia aurago*	2	2010	2011
2273	*Xanthia togata*	4	2009	2011
2274	*Xanthia icteritia*	7	2001	2011
2275	*Xanthia gilvago*	1	2011	2011
2278	*Acronicta megacephala*	3	2010	2011
2281	*Acronicta alni*	1	2010	2010
2284x	*Acronicta tridens/psi*	2	2010	2010
2289	*Acronicta rumicis*	3	2007	2011
2293	*Cryphia domestica*	2	2001	2010
2297	*Amphipyra pyramidea*	2	2009	2011
2298	*Amphipyra berbera*	2	2009	2009
2299	*Amphipyra tragopoginis*	6	2001	2011
2305	*Euplexia lucipara*	5	2007	2011

		Records	First Recorded	Last Recorded			Records	First Recorded	Last Recorded
2306	*Phlogophora meticulosa*	6	2006	2011	2375	*Rhizedra lutosa*	3	2010	2011
2312	*Ipimorpha subtusa*	4	2010	2011	2379	*Coenobia rufa*	1	2004	2004
2314	*Parastichtis ypsillon*	2	2010	2011	2380	*Charanyca trigrammica*	1	2007	2007
2318	*Cosmia trapezina*	6	2001	2011	2381	*Hoplodrina alsines*	6	2009	2011
2321	*Apamea monoglypha*	16	2001	2011	2382	*Hoplodrina blanda*	4	2001	2011
2322	*Apamea lithoxylaea*	7	2001	2011	2385	*Spodoptera exigua*	1	2011	2011
2326	*Apamea crenata*	5	2008	2011	2387	*Caradrina morpheus*	7	2001	2011
2327	*Apamea epomidion*	1	2010	2010	2389	*Paradrina clavipalpis*	4	2007	2011
2330	*Apamea remissa*	4	2010	2011	2397	*Panemeria tenebrata*	1	2004	2004
2331	*Apamea unanimis*	1	2011	2011	2410	*Protodeltote pygarga*	1	2010	2010
2334	*Apamea sordens*	9	2007	2011	2421	*Bena bicolorana*	1	2001	2001
2336	*Apamea ophiogramma*	2	2010	2011	2422	*Pseudoips prasinana*	1	2011	2011
2337x	*Oligia strigilis*	11	2007	2011	2434	*Diachrysia chrysitis*	8	2001	2011
2339	*Oligia latruncula*	1	2011	2011	2439	*Plusia festucae*	6	2004	2011
2340	*Oligia fasciuncula*	8	2001	2011	2440	*Plusia putnami gracilis*	1	2009	2009
2341	*Mesoligia furuncula*	3	2001	2011	2441	*Autographa gamma*	20	2001	2011
2342	*Mesoligia literosa*	2	2001	2004	2442	*Autographa pulchrina*	7	2006	2011
2343x	*Mesapamea secalis agg.*	9	2001	2011	2443	*Autographa jota*	2	2001	2011
2345	*Photedes minima*	2	2010	2011	2444	*Autographa bractea*	1	2010	2010
2352	*Eremobia ochroleuca*	8	2001	2011	2450	*Abrostola tripartita*	7	2001	2011
2353	*Luperina testacea*	10	2001	2011	2469	*Scoliopteryx libatrix*	2	2010	2010
2357	*Amphipoea lucens*	1	2004	2004	2474	*Rivula sericealis*	15	2004	2011
2360x	*Amphipoea oculea agg.*	1	2001	2001	2477	*Hypena proboscidalis*	10	2001	2011
2361	*Hydraecia micacea*	11	2001	2011	2489	*Zanclognatha tarsipennalis*	3	2001	2011
2364	*Gortyna flavago*	5	2001	2011	2492	*Herminia grisealis*	3	2001	2010
2369	*Nonagria typhae*	1	2004	2004					

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BROWNFIELD SITES AND MOTH DIVERSITY IN THE TEES ESTUARY

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Abstract

Studies relating to the moth fauna occurring on brownfield sites in the Tees estuary in north-east England are reported, including a number of species with first records for County Durham (VC 66), including Saltern Ear *Amphipoea fucosa*. Other important new records and key habitat indicator species are also discussed.
Keywords: Brownfield, Industry, Moth, Tees.

Brownfield sites in the Tees estuary – a context

Situated in the north-east of England, the Tees Estuary is within an area now referred to as the Tees Valley (formerly Teesside). For the purpose of this paper the term 'north-east England' refers to the geographical area covered by the counties of Durham, Northumberland and the former counties of Cleveland and Tyne & Wear; while reference to the 'Tees Estuary' denotes locations within the maximum tidal reach of the river from the Tees Barrage to Teesmouth, a distance of approximately 16 km. The estuary area falls within four unitary authorities, which were formed after the dissolution of the County of Cleveland in 1996. These boroughs are Hartlepool, Middlesbrough, Redcar & Cleveland and Stockton-on-Tees.

Plate 10. Neutral grassland that develops on brownfield sites such as here at Billingham supports a rich diversity of moth species.

In terms of the definitions relating to biological recording, those areas north of the River Tees, which were formerly part of County

Durham (Hartlepool and Stockton-on-Tees), are included as part of Watsonian Vice-county 66; areas south of the river, which were once part of North Yorkshire (Middlesbrough and Redcar & Cleveland), are within VC 62 (North-east Yorkshire).

The Tees Estuary is heavily industrialised and urbanised, a process which started in the early 1800s as the steel industry developed along the River Tees (North, 1975). Large areas of the estuary, such as Seal Sands, were reclaimed from the sea using dredgings and blast furnace slag, the latter being a by-product arising from the manufacture of iron and steel. Land reclamation continued until the 1970s. Today industry is still a major feature of the Tees Estuary, particularly heavy engineering, petrochemicals and steel. Much of this is situated on reclaimed land. Economic developments are very much in evidence within the estuary and its hinterland, but there is also a significant nature conservation interest. There are important areas outside of the developed areas which enjoy statutory protection. The largest areas are notified as the 'Teesmouth and Cleveland Coast Special Protection Area' and the 'Tees and Hartlepool Foreshore and Wetlands Site of Special Scientific Interest' which are coincident.

Although outside of the main protected areas, many of the industrial areas across the estuary have for some considerable time been recognised as being important for their wildlife interest (Smith, 1988). The definition of what constitutes a post-industrial or brownfield site is open to debate and can be very confusing, though however defined they are widely recognised as having a great deal of importance for their invertebrate fauna, for example in the East Thames Corridor (Harvey, 2000 and other sources).

In recognition of the importance of brownfield habitats for invertebrates, 'Open Mosaic Habitat on Previously Developed Land' (OMH) was added to the UK Biodiversity Action Plan in 2007 as a Priority Habitat. OMH is listed as a habitat of principle importance on section 41 of the Natural Environment and Rural Communities Act, 2006 (NERC Act).

The Tees Estuary industrial sites are atypical of brownfield land in that the majority are still occupied. Some of the larger sites have parts with a high biodiversity potential as a result of having been largely untouched for many years and being closed to public access for reasons of safety and security. A small number of brownfield sites in the area are post-industrial and several sites, such as Maze Park and Gravel Hole, are managed as nature reserves (Tees Valley Wildlife Trust, 2012).

It is the restricted access to many of the Tees sites that has led to a poor understanding of their importance for invertebrates. Systematic study of the moth fauna has been lacking in this potentially important area. This paper details work carried out by the Industry Nature Conservation Association (INCA) in conjunction with a number of partner organisations over the four year period between 2008 and 2011 to begin to address this knowledge gap.

Habitat diversity on brownfield sites in the Tees estuary

There is a great diversity in habitat within brownfield areas in the Tees estuary that is both a function of relic habitat and land use. Indeed there can be a considerable variation in the physical and chemical characteristics of the land between adjacent sites and even within a single site. This variation is dependent upon previous or existing land use and can involve difference in pH, levels of historical land contamination and very often difference in topography, land drainage and aspect.

The habitat is influenced in many areas by the presence of weathered blast furnace slag which in addition to use as infill in reclaimed areas has been used extensively to create hard-standing on industrial sites. The slag is mildly alkaline and consists primarily of a mixture of the aluminosilicate and silicate compounds of calcium and magnesium (Environment Agency, 2012). This substrate supports a range of specialised calcicolous plants when left undisturbed over a number of years and can result in a flora which is more reminiscent of calcareous grassland.

Wetland priority habitats which are associated with the Tees estuary brownfield sites include reedbeds and saltmarsh, while the grasslands growing on weathered slag (locally called 'slag grassland') are referred to as 'brownfields' within the Tees Valley Biodiversity Action Plan (Tees Valley BAP Partnership, 2012). In the UKBAP this habitat is termed 'Open Mosaic Habitat on Previously Developed Land', but the national definition refers to 'historical industrial use' (Riding *et al*, 2010). This does not quite fit for many of the sites within the industrial belt of the Tees Valley as most are currently occupied and are operational. It does however capture the true diversity of much of the open grasslands on the larger industrial sites, which are mosaics of habitat types rather than a single entity.

Sand dunes and coastal grassland are also well represented on sites at Teesmouth.

Key indicator species of selected habitats

Grassland

The structure and type of grassland present on the Tees brownfield sites is very varied, often as a result of previous or existing land use. Much of the open mosaic habitat on these sites comprises of semi-improved calcareous grassland growing on the low nutrient slag substrate (Mann *et al*, 2009). This 'slag grassland' is characterised by a very short, open, species-rich sward with frequent bare patches.

Many plants which are highly localised on the Magnesian limestone of the wider countryside in east Durham are both abundant and widespread in such places. The floral diversity includes Bee Orchid *Ophrys apifera*, Bird's-foot Trefoil *Lotus corniculatus*, Blue Fleabane *Erigeron acer*, Carline Thistle *Carlina vulgaris*, Common Centaury *Centaurium erythraea*, Kidney Vetch *Anthyllis vulneraria* and Yellow-wort *Blackstonia perfoliata*. Such areas support established

Plate 11. Neutral grassland at Billingham. Moths here include *Hellinsia lienigiana* Zeller, which is rare in the region.

Plate 12. Dune grassland at Redcar steelworks supports species such as the Lyme Grass *Chortodes elymi* (Tr.).

Plate 13. Slag grassland at Seal Sands. This habitat is rich in calcicolous plants and supports a wide range of moths whose larvae feed on them.

populations of regionally local moth species including the Annulet *Charissa obscurata* (D.& S.) which has so far only occurred at Teesport. Barred Rivulet *Perizoma bifasciata* (Haw.) seems to be focused on sites inland around Billingham where Red Bartsia *Odontites verna* is more frequent, while the Small Elephant Hawk-moth *Deilephila porcellus* (L.) is more widespread – associated with Lady's Bedstraw *Galium verum* on brownfield sites both north and south of the river. The

Nationally Notable *Syncopacma sangiella* (Stt.) occurs among Bird's-foot Trefoil which grows extensively on the Brinefields. There is only one post-2000 record of this moth from VC 66.

Eucosma conterminana (Guen.), a Nationally Notable tortricid, is now reported from a number of brownfield sites across the estuary where Wild Lettuce *Lactuca virosa* flourishes. There are only a handful of other records of this species in north-east England and the record of 3 July 2008 from Billingham was the first for VC 66.

Other than two records dating from 1800, there are only three records of the local plume moth *Stenoptilia zophodactyla* (Dup.) from the north-east, which relate to a single moth recorded in the Seal Sands area in 1990 and two more recent records from south Northumberland in 2010 and 2011 (Tams, 2012). Rearing larvae found in seed pods of Yellow-wort taken in September 2010 led to the discovery of strong populations of this species at Greenabella Marsh and Seal Sands. It is also present in similar habitat at Teesport in VC 62. Yellow-wort is often abundant on brownfield sites where blast furnace slag is present so this moth is actually likely to be fairly common.

Mesotrophic or neutral grasslands are also present within the grassland mosaic where blast furnace slag is absent. The floral diversity in these areas includes Bird's-foot Trefoil, Common Mouse-ear *Cerastium fontanum* and taller herbs such as Black Knapweed *Centaurea nigra*, Broad-leaved Dock *Rumex obtusifolius*, Common Nettle *Urtica dioica,* Mugwort *Artemisia vulgaris,* Ox-eye Daisy *Leucanthemum vulgare*, Tansy *Tanacetum vulgare* and Yarrow *Achillea millefolium*. Invasive ruderal species such as Bramble *Rubus fruticosus*, Creeping Thistle *Cirsium arvense*, Ragwort *Senecio jacobaea* and Rosebay Willowherb *Chamerion angustifolium* are often a feature in these areas where the ground has been disturbed.

These neutral brownfield grasslands support a number of regionally scarce species. Among these *Hellinsia lienigiana* (Zell.) a plume moth using Mugwort, is recorded from a site in Billingham. The moth reported on 30 June 2010 was the first record for VC 66; it is very local and in the north-east area is also known from occasional records in Northumberland (Tams, 2012) and Yorkshire (Beaumont, 2002). The plume moth, *Gillmeria ochrodactyla* (D.& S.), which occurs locally in the north-east, was found among Tansy at Portrack Marsh. Another Tansy-feeding species, *Isophrictis striatella* (D.& S.) also occurred at this site. This local species is known from only a small number of records in this region. The very localised Marsh Pug *Eupithecia pygmaeata* (Hb.) has so far been found only at one brownfield site, Maze Park, where it flies among *Cerastium*.

Interestingly, 2011 saw the appearance of Great Mullein *Verbascum thapsus* across a number of brownfield sites in the estuary where it has not been seen before. On one site at Billingham it was accompanied by a larva of The Mullein *Shargacucullia verbasci* (L.) which although common in the south of England, is rare on sites here.

While thistle species can become a problem on the Tees estuary brownfield sites, there are several local moths using the various species as larval foodplant which have been found on brownfield sites in the region. Prior to this work *Phlyctaenia perlucidalis* (Hb.) had only been reported from North Gare, in the northern part of the estuary and was the only record for this moth in North-east England. It is now known to occur on five sites across the northern part of the estuary, including three in Billingham, at Portrack Marsh and also at Seal Sands. There are no records to date from brownfield sites in the southern part of the estuary. Another scarce, thistle-feeding species which is known from the Tees brownfields sites is *Myelois circumvoluta* (Geoff.). This local species has a scattered distribution within the region and occurs on brownfield grassland at Maze Park and Portrack Marsh.

Rosebay Willow-herb, although potentially invasive, can also be useful for a number of species. One such species, *Mompha sturnipennella* (Tr.), was found among this plant at Portrack Marsh. The moth is spreading north through Yorkshire and has a scattering of records in the north-east. Also at Portrack Marsh was the gorse-feeding Gelechiid *Brachmia blandella* (Fabr.). The moth found on 3 July 2011 is the first record for Durham. It is scarce across the Tees in the northern part of Yorkshire, but is often widespread and common further south.

Extensive areas of coastal dune grassland are present both north and south of the Teesmouth, at North Gare and South Gare respectively. The area of dunes at Teesmouth is the most extensive on the north-east coast between Spurn Point in East Yorkshire and those in south Northumberland. Very little of this habitat, however, is present on brownfield sites in the Tees estuary. Of this much is focused around the northern boundary of the steelworks site at Redcar which has an area of around three hectares of dune grassland at Bran Sands. This adjoins the area of sand dunes at South Gare. The dune grassland is rich in flora which is typical for the area and is very much dominated by Lyme Grass *Leymus arenarius* and Marram *Ammophila arenaria.*

Dune grassland on the steelworks site is home to a number of nationally notable moths, including Lyme Grass *Chortodes elymi* (Tr.), Shore Wainscot *Mythimna littoralis* (Curtis) and the Pyralid *Evergestis extimalis* (Scop.). Regionally local species recorded from these dunes include *Agriphila geniculea* (Haw.), *Agriphila latistria* (Haw.), *Eudonia angustea* (Curtis), *Phycitodes maritima* (Tengst.), Archer's Dart *Agrotis vestigialis* (Hufn.), and Heart and Club *Agrotis clavis* (Hufn.).

The record of *Pima boisduvaliella* (Guen.) from a pumping station at nearby Teesport on 27 July 2011 is only the third record of this nationally rare moth from the Yorkshire coast. The other two were recorded in 2003, just a few kilometres distant at Redcar Steelworks by Colin Plant, reported in Langmaid and Young (2004) and in 2006, when several were seen a little further south at Marske in June (D. Money, S. Farish; unpublished data).

Plate 14. Habitat at North Tees including relic saltmarsh, which supports Saltern Ear *Amphipoea fucosa* (Freyer) and Crescent Striped *Apamea oblonga* (Haw.).

Plate 15. *Phragmites* reedbed on a North Tees brownfield site. Moths here include *Archanara dissoluta* (Tr.), *Mythimna obsoleta* (Hb.) and *Arenostola phragmitidis* (Hb.).

Saltmarsh

This habitat in the Tees Estuary is largely restricted to the Boroughs of Hartlepool and Stockton-on-Tees. The land area covered by this habitat is relatively small, approximately 26.5 hectares (Gibson, 2003) which is diminutive in a national context. It is nevertheless of regional importance as there are few areas of saltmarsh along the coast between the Humber estuary and the Scottish border. It is a rare habitat in the Tees Valley and is also a UKBAP Priority Habitat.

One area of saltmarsh, comprising an area of approximately five hectares in the North Tees area of the Borough of Stockton-on-Tees is an operating brinefield. Habitat on this site consists of a rich mosaic, including relic saltmarsh and areas which now have a halophytic saltmarsh vegetation as a result of deliberate application of brine as a nature conservation measure to encourage habitat rich in saltmarsh plants including various species of Glasswort *Salicornia* spp. and Common Saltmarsh-grass *Puccinellia maritima*.

In surveys of the moths of this site during 2010 and 2011 at least five nationally important saltmarsh indicator species were found. The abundance of some of the scarcer species was also noteworthy. This includes the Dog's Tooth *Lacanobia suasa* (D.& S.) recorded on 17 June 2010 and the Saltern Ear *Amphipoea fucosa* (Freyer) recorded on the 4 August 2010. At least 40 individuals of the former species and 20 of the latter were found in surveys during summer 2010 indicating that both are well established on the site. Saltern Ear, presumably as wanderers from this main population, has also been found in small numbers on sites at Cowpen Bewley and Seal Sands 3.5km west and 1 km south-east of this location respectively (Woods, 2011a; Woods, 2011b). This finding is important especially in view of the fact that both species were previously known only from a very few sites in North-east England (Tams, 2012). The record of Saltern Ear is particularly noteworthy as it is new to the VC 66 fauna and the nearest known established colonies are at Spurn Point in Yorkshire and on Holy Island in north Northumberland, both some distance from Teesmouth.

In addition to the Dog's Tooth and Saltern Ear other significant records of moths from the same site include specialised saltmarsh species such as the Crescent Striped *Apamea oblonga* (Haw.), which is associated with various species of Saltmarsh-grass *Puccinellia* spp. This moth was recorded initially on the basis of four specimens on 4 August 2010, but then in the peak emergence season of this species in good numbers (23 specimens) on 11 July 2011. The site remains as the only known breeding population of this species in North-east England.

A number of interesting microlepidopteran species were also found on the same site. Of these, *Coleophora salicorniae* Hein. was first represented by six moths which were recorded on 4 August 2010, the first for VC 66 and apparently the most northerly record for this species in the UK, the nearest again being Spurn

Point. It was also recorded on the Brinefields on 11 July 2011. Various species of Glasswort *Salicornia* spp. are used as the larval foodplant by this moth. These plants abound in parts of the Brinefields site. The crambid *Agriphila selasella* (Hb.) was also recorded from the site on 4 August 2010. This local species, which uses *Puccinellia maritima* and other grasses, is only known from three previous records in VC 66.

Two Gelechiid moths were represented among the scarcer saltmarsh microlepidopteran species occurring on the Brinefields. *Scrobipalpa salinella* (Zell.), of which three were recorded on 17 June 2010, is the first for VC 66 since at least 1912 while the Nationally Notable species *Monochroa tetragonella* (Stt.), taken as a single specimen on 17 June 2010, is represented by only two records from nearby Greatham in July 1881.

Reedbed

The Tees Valley has around 170 hectares of reedbed (Gibson, 2003). Industrial sites across the Tees estuary are home to a significant amount of this, which is often found as small stands within the overall habitat mosaic found on such sites. Reedbed is in itself scarce, being listed as a UKBAP Priority Habitat.

Many of the reedbeds on industrial brownfield sites in the northern part of the Tees estuary and in Billingham have become important for wainscot species which are at the northern edge of their range. As more of the larger reedbeds are investigated it is increasingly being found to be the case that those which are dominated by Common Reed *Phragmites australis* support established populations of Brown-veined Wainscot *Archanara dissoluta* (Tr.) Obscure Wainscot *Mythimna obsoleta* (Hb.) and Southern Wainscot *Mythimna straminea* (Tr.). These species were first reported in the Teesmouth area during 2004 and 2005 from a reedbed at Dorman's Pool (J. Duffie, A. Wheeldon; unpublished data).

In addition the Fen Wainscot *Arenostola phragmitidis* (Hb.) is the most recent to have been found to have become established. Apart from one record originating from 1976 during survey of a reedbed at Haverton Hill in the Borough of Stockton-on-Tees (Russell McAndrew, pers.comm., 2010) it was hitherto unknown in north-east England. Six areas of reedbed on brownfield sites in the North Tees and Billingham areas have now been shown to support this species which is resident at a low density on all of the sites with records spanning the period mid July to mid August. It has also now been found in Northumberland in 2011 (Tams, 2012).

The most important reedbed to date has been shown to be Portrack Marsh which supports good populations of Fen Wainscot and most of the other species (Woods, 2011b). Portrack Marsh was also the only brownfield wetland site to support populations of Double-lobed *Apamea ophiogramma* (Esper) and *Eudonia pallida* (Curtis) which are very local in north-east England.

Conservation of brownfield habitat in the Tees estuary

The reported study of moths on brownfield sites in the Tees estuary has led to the discovery of resident populations of a number of species that are of national importance. These species lack statutory protection and they occur on sites which by the nature of their economic function also do not have statutory protection. Inevitably the biggest single threat to biodiversity in the Tees estuary is habitat loss or fragmentation in such an industrialised area where there is intensive pressure for land development. Areas can become so small and isolated that they begin to support critically small population sizes which cannot survive. Lack of active management can also be an important factor causing habitat loss in that reedbeds and grasslands will ultimately revert to scrub. It is, however, a quirk of fortune that many brownfield sites within the estuary have large areas of low-nutrient slag as substrate. This arrests the development of a dense sward containing competitive plant species.

Today's mantra in conservation is very much about a landscape approach that aims to link local populations by enhancing the connectivity of habitat across areas rather than by working with local populations in isolation. It can be seen that brownfield, post-industrial sites and industrial areas on the Tees are very important in this context, so it is important to adopt an approach that works with landowners. While this is not always possible some large organisations in the estuary are allowing parts of their land-holding to be managed for the purpose of nature conservation thus providing a valuable contribution to this landscape level approach to conservation. INCA has worked with a number of industrial organisations across the estuary since 1989 to achieve this aim. Working in partnership with industrial organisations to retain areas that have been identified as having a high potential for biodiversity has been very successful. To date at least six commercial organisations are working to maintain or enhance parts of their sites for biodiversity an approach which can only benefit wildlife including moths.

Thus, in summary, although there are a number of factors that potentially threaten the moth biodiversity in the geographical area covered by this paper there is also hope that a balance might be achieved which will allow wildlife to continue to co-exist successfully with the continuing need for progression and regional development.

Acknowledgements

Thanks are due to various landowners for granting access permission to carry out moth recording on their sites. This includes BP, Huntsman Pigments, Lucite International, Northumbrian Water Ltd (NWL), SABIC UK Petrochemical Ltd and the Tees Valley Wildlife Trust. NWL provided funding to conduct surveys on a number of their sites in 2011 as part of their regional Biodiversity Action Plan. I would also like to thank Buglife – The Invertebrate Conservation Trust, who in

conjunction with the Tees Valley Wildlife Trust are partners in a project which is jointly financed by Entrust and the SITA Enriching Nature fund. This is focused on the creation and management of habitat for brownfield invertebrates on four sites in the Tees Valley. In terms of the Lepidoptera specialists, I express my gratitude to Harry Beaumont, the Microlepidoptera recorder for Yorkshire, for identification and verification of some of the microlepidopteran species mentioned in this paper; to Jon Clifton for confirmation of the record for Saltern Ear and to County Moth Recorders Keith Dover (VC 66), Charles Fletcher (VC 62) and Tom Tams (VC 67 and VC 68) for confirming the distributional status of the scarcer species. A number of the visits to various sites were accompanied by amateur moth enthusiasts from across the Tees Valley who are too numerous to name but their help is also very much appreciated. Helpful comments relating to this paper were received from a number of colleagues.

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Unseasonal moths in Warwickshire 2011

I was interested to read of the December records of *Apamea monoglypha* (Hufn.) Dark Arches and *Orthosia gothica* (L.) Hebrew Character in the last issue of this journal. With these in mind, I can report that *A. monoglypha* appeared in my garden MV trap at Charlecote on 9 and 17 November 2011, followed by two more on 22 December in the same year.

Also of interest was a very early *Orthosia gothica* in a garden MV trap in Warwick on Christmas night 25 December (S. D. Taylor). — DAVID C. G. BROWN, Jackson's Lawn,Charlecote,Warwick CV35 9EW.

***Mompha bradleyi* Riedl (Lep.: Momphidae) in West Norfolk**

On 30 September 2011, I caught a specimen of a *Mompha* in my garden at Dersingham, Norfolk (VC 28) that I could not immediately identify; accordingly, I stored it in a tube for a later look. However, it remained neglected and forgotten until December when I discovered to my horror that the moth had somewhat decayed. Undeterred, I made a slide of the genitalia for critical examination and subsequently identified it, using Koster, S. & Sinev, S (2003. *Microlepidoptera of Europe, 5: Momphidae. 1.* Apollo Books), as *Mompha bradleyi*. I then realised that this was probably a new species for Norfolk and so sent the slide to Jon Clifton for confirmation, which was immediately forthcoming.

This is the second record of *M. bradleyi* for East Anglia, the first being made in Suffolk (VC 25) by Paul Kitchener, on 26 October 2010, the identity again confirmed by Jon Clifton (see *Ent Rec* **123**: 266). This species is clearly either expanding its range or it has been overlooked in the past. — DICK JONES, 14 Post Office Road, Dersingham, King's Lynn, Norfolk PE31 6HP.

***Bohemannia auriciliella* (Joannis, 1908) (Lep.: Nepticulidae) – New to Buckinghamshire**

This tiny nepticulid moth was taken at mercury vapour light at Hodgemoor Wood in Buckinghamshire on 2 July 2011. The wood is part of the ancient woods listed for Buckinghamshire and is currently managed by the Forestry Commission, being leased from Buckinghamshire County Council. It is largely made up of old oaks and younger birch and contains small remnants of acid heath. It lies atop of the Chiltern Hills near to Amersham. The moth in question was dissected and then tentatively identified as *Bohemannia auriciliella* by myself before being photographed and sent to John Langmaid for a second opinion. He wasn't sure, so on his suggestion I sent the image across to Erik van Nieukerken for confirmation. His reply was, "There is little doubt that these genitalia can only be *auriciliella*: characteristic two large cornuti, shape of gnathos, uncus, valvae". Looking through historical records for this moth, it appears that this may be just the 5th Vice County record, with not many more individual records in total for the UK.

There is an initial record of a specimen, found in Kent in 1973, followed by an older example being re-discovered after this, in a collection in Copenhagen, but originating in Hampshire and dating from 1937. After this there was a 1993 record from Wiltshire, then another from Berkshire in 2001 followed by a second Hampshire record in 2003 and now Buckinghamshire in 2011. The larvae are thought to feed on Birch *Betula*. My thanks go to John Langmaid and Erik van Nieukerken for their help in confirming the identification. — PETER HALL, Melanthia, Chiltern Road, Ballinger Common, Buckinghamshire HP16 9LH.

Eucosma campoliliana (D.& S.) (Lep.: Tortricidae): new to the Shetland Isles

Amongst a batch of moths sent to me for determination from the Shetland Isles and caught over the 2011 season, one was found to be the tortricid moth *Eucosma campoliliana* ([D. & S.]) which was a new record to this archipelago. It was taken by George Petrie at Ocraquouy, central Mainland on the 26 July 2011.

The moth is known from most northern Scottish vice-counties, including Orkney, but whether is may become resident on the Northern Isles remains to be seen as the foodplant, Common Ragwort *Senecio jacobaea,* is very rare there. A possible alternative foodplant is Marsh Ragwort *S. aquaticus*, which is very common there in lowland pasture and rough ground.

Also amongst this sample of moths was Shetland's fourth record of *Thera obeliscata* (Hb.) (Geometridae), the Grey Pine Carpet, caught by Paul Harvey at Virkie, South Mainland on 4 September 2011.

Many thanks to Mike Pennington for information regarding ragworts in Shetland. — JON CLIFTON, Kestrel Cottage, Station Road, Hindolveston, Norfolk NR20 5DE.

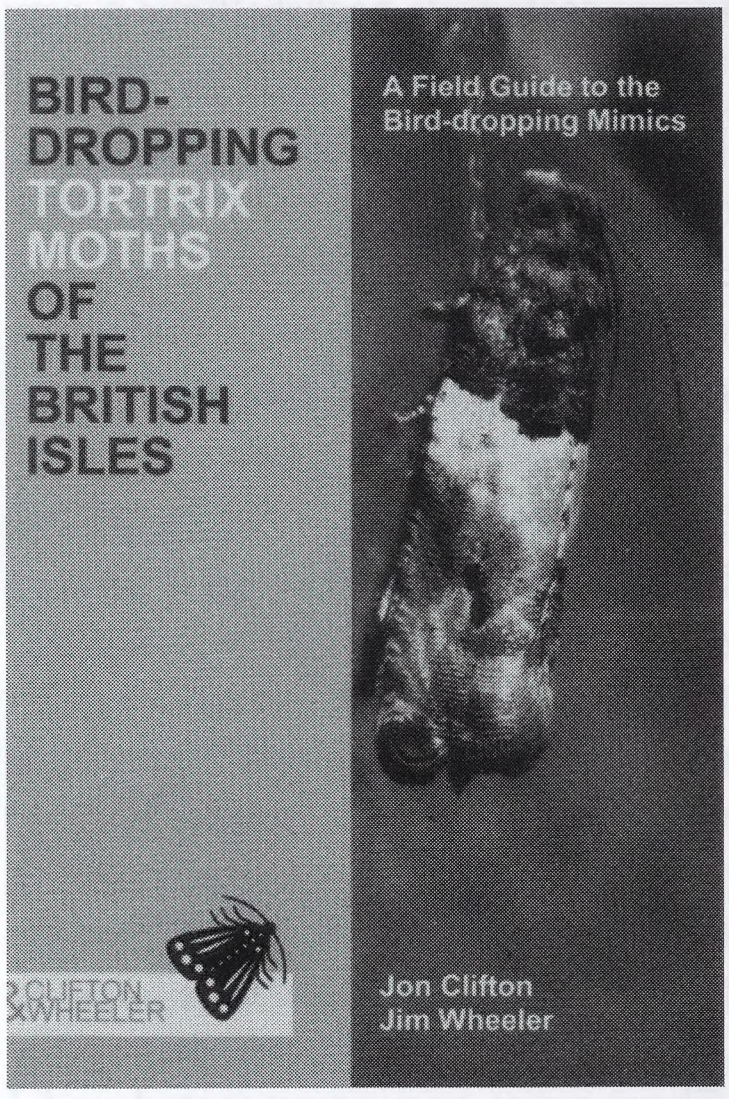
Agonopterix subpropinquella (Stainton) (Lep.: Oecophoridae) reared from Saw-wort *Serratula tinctoria*

On 4 June 2011 I collected two early instar larvae that were mining leaves of Saw-wort *Serratula tinctoria* east of Le Creux de Lasse, St Mary, Jersey, Channel Islands. Later they fed on the upper surface of the leaves, rolling them into tubes. A female *Agonopterix* sp. emerged on 9 July 2011; nothing resulted from the other larva.

Although the moth appeared to be *Agonopterix subpropinquella* (Stainton), *Serratula tinctoria* is not given as a larval foodplant by Langmaid (2002. *The Moths and Butterflies of Great Britain and Ireland* **4** (1): 151-152) whereas it is reported for *A. propinquella* (Treitschke), but only on the Continent (Langmaid, 2002. *op. cit.*: 155-156). A genitalia preparation, however, confirmed that the moth was indeed *A. subpropinquella*. I am not aware of any record of this from *Serratula tinctoria* since the publication of *The Moths and Butterflies of Great Britain and Ireland* **4** (1). — R. J. HECKFORD, 67 Newnham Road, Plympton, Plymouth, Devon PL7 4AW.

BOOK REVIEW

Bird-dropping Tortrix Moths of the British Isles. A Field Guide to the Bird-dropping Mimics by **John Clifton and Jim Wheeler**. 70pp., A5, paperback, ISBN: 978-0-9568352-0-8. Privately published, 2011. Available from the publisher at ALS, Kestrel Cottage, Station Road, Hindolveston, Norfolk NR20 5DE or via *www.angleps.com*. £15.00, plus £2.60 UK postage and packaging.



The several texts covering tortrix moths that are available are either expensive or out of print and are aimed largely at experts, or at least those who, unlike me, have progressed beyond the beginner stage. This book, on the other hand, has taken a purely artificial yet immediately familiar group of moths and has been crafted so as to allow either for easy identification without becoming bogged down in minute details or to point the reader in the right direction where identification is not possible without dissection. The result is a wonderfully clear, concise identification guide that appeals to all levels of experience and would be a good addition to any bookshelf.

The introduction is short and to the point, giving explanation of why certain species have been included and highlighting the problems of a lack of a definitive list for the bird-dropping mimics, as well as a few pointers to aid the identification process, such as using a good quality hand lens to see small details and when to retain specimens for confirmation by an experienced recorder. Then follows useful information, such as an illustrated guide to morphology, to aid those with less familiar with specific terms such as tegula, ocellus and strigulae, a key for the flight graphs, national status and a species list. From then the book works through each species systematically, one moth per page, until reaching the full colour, thumbnail index at the back. The latter is an especially useful tool for one not familiar with these tortrix moths but who nevertheless requires a quick, visual reference to aid identification.

The body of the book is attractive, well laid out and allows for total ease in establishing key facts about each species – a welcome and refreshing approach to a field guide. How many beginners have felt frustrated at having to wade through a page of information laced with scientific terms when all they needed to know could be expressed in a few sentences? There is none of that with this field guide, with the layout configured so that it is easy to establish whether the specimen on the page matches the one being examined.

Each page follows a straightforward pattern, with species and sub species name at the top followed by the Bradley checklist number in square brackets. If available, an English name follows. Then follow two good-sized photos, one showing the moth in its natural state, and the other of a set specimen with annotation to key identification points. A location map, flight graphs, size (wingspan), the favoured food plants and national status follow either in

picture form or as short points. A small description at the bottom of the page then elaborates and provides any additional information relevant to the species, including whether it requires dissection to determine identification and most usefully listing other similar species with relevant page numbers for comparison.

There is almost nothing to criticise. It may have been useful to have included an explanation of the mystery numbers in square brackets (which, I am told, are the Bradley *Checklist* numbers); this book caters for absolute beginners in every other way, but on this one detail makes the all too familiar assumption that something is already known.

Overall, however, this is a valuable addition to any ecologist's bookshelf and a very practical guide for use in the field where clear, straight-forward information is needed. A great reference guide for beginners and those who have experience alike.

R. Plant

A very early record of Brindled Pug *Eupithecia abbreviata* (Steph.) (Lep.: Geometridae)

On 14 February 2012 I visited a favourite, small, oak woodland in an attempt to record the first Spring Usher *Agriopis leucophaearia* ([D. & S.]) for Fifeshire (VC85). It was a relatively mild evening and there were some insects flying as I set up the trap in a small clearing in the gathering darkness. I'm sorry to say that I had not checked my generator beforehand and it expired at around 7.30pm after just 90 minutes of trapping time. However, I was pleased to find a healthy number of Pale Brindled Beauty *Phigalia pilosaria* ([D. & S.]) fluttering on surrounding tree trunks along with a few *Tortricodes alternella* ([D. & S.]), a Chestnut *Conistra vaccinii* (L.) and as I had hoped, the first vice county record of Spring Usher *Agriopis leucophaearia* ([D. & S.]). I was also rather amazed to see the outline of two pugs on the ground sheet. These were very unexpected and I tentatively identified them both as Brindled Pug *Eupithecia abbreviata* (Steph), later confirmed by Roy Leverton from a photograph.

According to Mironov (2003. *The Geometrid Moths of Europe* vol. 4 Apollo Books), the earliest flight time of this species, presumably over the whole of Europe, is "early March". Riley & Prior (2003. *British and Irish Pug Moths - A Guide to Their Identification*) suggests the last week in February. The East of Scotland Butterfly Conservation website shows flight times of all Scottish species based on records submitted to the National Moth Recording Scheme (*http://www.eastscotland-butterflies.org.uk/mothflighttimes.html*) and the earliest record there is also the last week of February, with mid-March being more usual. It might be that mine is the earliest record of Brindled Pug *Eupithecia abbreviata* anywhere – all the more amazing when one considers that Scotland is at the northern edge of its range.

Thanks to Roy Leverton for confirming my identification of the pugs and for supplying literature references. — DUNCAN W. W. DAVIDSON, 140 Pitcorthie Drive, Dunfermline KY11 8BJ (E-mail: *duncan@dwwd.freeserve.co.uk)*.

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